

The Tennessee Wildlife Resources Agency

"Protecting, preserving, and perpetuating Tennessee's wildlife and ecosystems."

STRATEGIC PLAN 2021-2027



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Introduction:

Tennessee's natural resources are among the most diverse in the nation. From the rugged Appalachian Mountains in the east to the Mississippi River floodplain in the west, the changes in elevation, land use, geology and topography create a wide range of habitat types that give rise to a great diversity of wildlife. Currently there are 330 species of fish, 77 mammals, 56 reptiles, 70 amphibians, and 340 birds known to inhabit or migrate through Tennessee. The number of invertebrate species, many of which are endemic to Tennessee, is equally impressive with 256 land snails, 99 aquatic snails, over 120 mussels, 96 crayfish and many insects. New species are also still being discovered.

Protecting these diverse habitats and the associated wildlife is a quality-of-life issue for many Tennesseans. Both the traditional, consumptive users of wildlife (hunters and anglers) and the non-consumptive users (wildlife watchers) have a stake in the proper management of wildlife. Recreational boaters expect to find clean water, sufficient access to water resources, adequate boating facilities, and a dedication to boating safety. The same standards are expected from those pursuing outdoor recreational activities on our Wildlife Management Areas (WMAs), refuges, and other Agency properties. Due to the extreme pressures exerted on our natural resources by numerous and diverse outdoor users, the Agency must remain vigilant and prepared to ensure our wildlife resources are not exploited or irrevocably impaired. Thus, decisions must be made to manage wisely and to protect the resources.

This Strategic Plan strives to anticipate and balance the needs of the wildlife and the public, and to develop strategies that will protect, enhance, and effectively manage our wildlife resources over the next six years.

Economics of Wildlife:

Every five years the U.S. Fish and Wildlife Service conducts a national survey to determine the number of users and the economic impact of hunting, fishing, and wildlife-associated recreation. In the 2011 report, data were provided at the state level, however, state level data were not provided in the 2016 report. According to their 2011 report, there were 923,000 hunters and anglers in Tennessee in 2011 (U.S. Fish and Wildlife Service 2012) comprising almost 20% of the State's entire population. When non-residents are included, almost one million people hunted or fished in Tennessee that year. Those same sportsmen and women generate 1.9 billion dollars annually in hunting and fishing related expenditures (trips and equipment). Add in Tennessee's two million wildlife watchers who spend almost 1 billion dollars annually, and it brings total annual wildlife-related expenditures in Tennessee to almost three billion dollars. Although the most recent report from 2016 did not provide data at the state level, a 5-year comparison of estimates from 2011 to 2016 shows a 16 percent increase in the total number of people 16 years and older participating in wildlife-related recreation activities in the United States.

History:

In 1949, the Tennessee Game and Fish Commission (TGFC) separated from the Department of Conservation and became a self-supporting agency. A board of commissioners guided the TGFC which was headed by the Executive Director. In 1974 the TGFC became the Tennessee Wildlife Resources Agency (TWRA), reflecting its responsibility for all wildlife. In 1977 the first Strategic Plan was developed, and the Agency began administering its Federal Aid program through a comprehensive management system. The Agency's Strategic Plan has been revised and updated several times with a new Plan published in 1982, 1987, 1994, 2000, 2006, 2014 and 2021.

The Agency continues to have a board of commissioners (see Statutory Authority) as the governing body with the Executive Director in charge of day-to-day activities. TWRA has approximately 700 employees, of which about one-fourth are full-time enforcement officers. The Agency owns or has conservation easements on approximately 600,000 acres of WMAs, refuges, and Agency fishing lakes. TWRA's funding mechanisms are divided into three broad areas: wildlife (terrestrial and aquatic), boating, and wetlands. Funding for the wildlife program is generated primarily by license sales and federal sources (federal sources include grants and excise taxes on certain sporting equipment). The boating safety program is funded through boat registration fees and federal funding. The wetland acquisition program is funded by a transfer tax on Tennessee real estate transactions.

Who we are:

The Tennessee Wildlife Resources Agency is the agency responsible for managing all wildlife species in the State of Tennessee and for enforcing and promoting the safe use of our lands and waters. We are an organization comprised of over 700 professionals dedicated to protecting and managing Tennessee's natural resources for the benefit of all citizens.

What we do:

The Tennessee Wildlife Resources Agency manages wildlife habitat on its Wildlife Management Areas and promotes habitat improvement on private lands; operates fish hatcheries that provide fish to stock public waters throughout the State; monitors fish and wildlife populations and recommends appropriate management actions; enforces wildlife laws; provides boating education and enforces boating safety laws; and provides opportunities for the public to hunt, fish, watch wildlife, and participate in outdoor recreational opportunities that are consistent with realistic conservation principles.

Vision:

The Tennessee Wildlife Resources Agency envisions wildlife populations and their associated habitats that fulfill their diverse ecological roles while also providing a broad range of recreational opportunities throughout the state.

Mission:

The mission of the Tennessee Wildlife Resources Agency is to protect, preserve, and perpetuate Tennessee's wildlife and ecosystems for the sustainable use and recreational benefits for our state's residents and visitors.

Statutory Authority:

Title 70 of Tennessee Code Annotated contains the laws governing the Wildlife Resources Agency.

Chapter 1, "Part 3 – Wildlife Resources Agency" includes:

70-1-301. Creation – Statement of Policy – (a) There is hereby created a wildlife resources agency which shall have full and exclusive jurisdiction of the duties and functions relating to wildlife formerly held by the game and fish commission or of any other law relating to the

management, protection, propagation, and conservation of wildlife, including hunting and fishing, except those powers and duties conferred upon the fish and wildlife commission as provided in § 70-1-206. *(Note: 70-1-206 defines the duties of the Commission, which includes appointing the executive director, approving the budget, and promulgating rules, regulations, and proclamations)*

(b) It is the policy of the state that the agency shall be nonpartisan and shall place first and foremost the welfare of the wildlife and its environment in the agency's planning and decisions, and to encourage, by every appropriate means, the full development of the state's natural resources to the benefit of all citizens of Tennessee, including, but not limited to, the creation of a comprehensive long-range management plan to integrate the wildlife resources agency's efforts and to implement and encourage full utilization of Tennessee's wildlife resources consistent with realistic conservation principles.

Chapter 4 of Title 70 includes:

70-4-101. Ownership and title to wildlife vested in state.-(a) The ownership of and title to all forms of wildlife within the jurisdiction of the state, as are not individual property under the laws of the land, are hereby declared to be in the state.

Strategic Planning:

The basic concept of strategic planning is that knowledgeable people will develop ambitious but realistic goals and objectives for an organization to strive for. They will identify potential problems or issues that may hinder the realization of those desired outcomes. Conversely, the planners may also identify opportunities that may help realize those same goals and objectives. Lastly, the planners will develop strategies to overcome the problems and issues or take advantage of the opportunities before them. The Strategic Plan, therefore, is meant to serve as a guiding document for the Agency to meet its current goals and objectives. If properly constructed and well thought-out, the plan should ensure success.

The Challenge - Developing a New Plan:

In 2019, the Tennessee Wildlife Resources Agency began a revision of our strategic plan to guide the next 6 years. In 2012, the Agency made a huge overhaul of our strategic plan. The Agency's long and storied existence centered on species management, therefore, historically the Agency developed and utilized a species-based strategic plan that focused primarily on game management. The primary programs identified in past Strategic Plans included White-tailed Deer, Turkey, Black Bear, Ruffed Grouse, Squirrel, etc. with only a few programs that captured all species under one platform, including Reservoirs, Large Rivers, Streams, Farm Game, and Non-game. The species-based focus served the Agency well in the early decades, especially since numerous game animals were in decline or even completely extirpated from their historic range.

Within the last few decades, many game populations recovered to the point where their persistence is no longer in question. In addition to the recovery of popular game animals, in 2005, the Agency developed and released their State Wildlife Action Plan (SWAP) which identifies species of Greatest Conservation Need (GCN). The SWAP plan was updated in 2015. This comprehensive plan identifies and ranks all species whose existence or viability is or may be threatened. Fortunately, the 1,400+ species found in Tennessee rely on similar environments that can be addressed using habitat as an umbrella program. The obvious platform to capture the multiple needs of these species is to develop habitat-based plans which, when given the proper attention, should ensure the persistence of the animals reliant upon those habitats. Hence, for the first time in the history of the Agency, the primary focus of the Wildlife Resource Program was to create a habitat-based approach to managing and protecting our State's wildlife resources.

In addition to creating a new habitat-based plan for resource management, the Agency was challenged with incorporating all the major functions of the Agency into one strategic plan. After long deliberations and much debate, it was determined that the Agency had four core functions that serve our one common mission. With the new plan we now have four core functions. The four core functions are: Wildlife Resource Management, Outdoor Recreation, Law Enforcement and Outreach and Communications. In addition to the four core functions, it should be noted that the TWRA also administers business management systems which support the primary core functions on a day-to-day basis. While these processes do not relate directly to the program goals within the Strategic Plan, they are essential to achieving many of the Agency's goals.

Core Functions:

As with most state wildlife agencies, there are more responsibilities given the Agency than simply resources management. Although resource management is the primary duty of the Agency, many citizens of Tennessee expect the Agency to provide other services as well. Fortunately, those services are closely tied to the Agency's primary purpose and are considered core functions. The four core functions of the Agency and their associated goals are:

- Wildlife Resource Management - To conserve and manage wildlife resources to provide diverse wildlife communities at appropriate levels.
- Outdoor Recreation - To increase opportunities for hunting, fishing, and boating and accommodate other outdoor recreation that is safe for users and the environment yet consistent with conservation principles. To supply both the public and Agency personnel with a constant flow of multimedia information necessary for attaining the management and conservation goals of the Agency, as well as the most current rules and regulations relating to the education and recruitment of outdoor participants.

- Law Enforcement - To protect and conserve Tennessee's wildlife resources and provide public safety through proactive and responsive law enforcement services.
- Outreach and Communication - To supply both the public and Agency personnel with a constant flow of multimedia information necessary for attaining the management and conservation goals of the Agency, as well as the most current rules and regulations relating to the education and recruitment of outdoor participants.

With many organizations, an overarching strategic plan does provide direction for on-the-ground management. Therefore, the Agency will use a step-down approach utilizing three distinct levels of planning; this is known as the planning hierarchy (Figure 1). They include:

Strategic Plan – provides an over-arching vision with broad-based goals and strategies for achieving these goals. One can consider this level as the “30,000 foot” level.

Operational Plan – provides more specific focus on a shorter timeframe and outlines exact strategies to accomplish specific objectives. There are two basic types of operational plans utilized by TWRA, regionalized habitat plans (i.e. Wildlife Management Area plans, Tailwater plans, Habitat Conservation Plans, or other area plans) and species plans (i.e. State Wildlife Action Plan, white-tailed deer, quail, cormorant, trout management, etc.). One can consider this level the “15,000 foot” level.

Implementation Plan – provides guidance to personnel conducting the work. These plans include but are not limited to project proposals, budget plans, field orders, procedures, and any other daily guidance issued by the Director's staff. These plans are developed internally. One can consider this the on-the-ground management level.

Although many of the operational plans have been written, all require constant attention and are in perpetual need of update. The Agency will strive to keep the existing plans updated and to develop plans where specific direction is lacking.

30,000 Feet			
Wildlife Resources	Outdoor Recreation	Law Enforcement	Outreach & Communications
15,000 Feet			
Species Plans	WMA Plans	R3	Other Plans
On The Ground			
Budgets	Field Procedures	Admin Procedures	Other Directives

In March 2020, a core team of individuals began the process of revising our new strategic plan. Over the next few months, multiple meetings were held to review the plan and develop a strategy for how it might be updated after the last major overhaul.

Upon receiving the outlines from each of the programs within this plan, the core strategic planning team reviewed all program outlines for consistency. The core strategic planning team then submitted a revised plan that was reviewed and revised by the Director's staff. The third draft was subjected to public review. The fourth draft was submitted to the Commission for review and approval, resulting in the final Strategic Plan.

Using this Plan:

Historically, the Tennessee Wildlife Resources Agency has been enrolled in a Comprehensive Management Strategy (CMS) with the U.S. Fish and Wildlife Service. This CMS, once approved, allows the Agency more discretion in deciding how to utilize and spend federal aid monies that are allocated through various programs (i.e. Pittman-Robertson, Dingell-Johnson/Wallop-Breaux,).

The Tennessee Wildlife Resources Agency's Strategic Plan is an important part of the Agency's comprehensive management system. The Plan informs the public of Agency' goals and objectives, imparts evaluative criteria for project proposals forming the Agency's work plan and budget; and, every three years, evaluates objective success and strategic effectiveness outlined in the Strategic Plan.

Goal:

To conserve and manage wildlife resources to provide diverse wildlife communities at appropriate levels.

Definition:

Tennessee Code Annotated (T.C.A.) defines wildlife as, "...wild vertebrates, mollusks, crustaceans, and fish," and it is the Agency's directive to manage the state's wildlife resources. The only way Tennessee's wildlife resources can be properly managed is if all basic requirements for life for each species are met and they are afforded the protection that ensures sustainability. This plan will focus on meeting the habitat requirements for all wildlife in Tennessee and will guide resource protection so all citizens of Tennessee can benefit and enjoy our renewable wildlife resources.

Wildlife Resources Management in Tennessee:

Historically, Tennessee has been home to a multitude of wildlife species. These species along with their associated habitats created a diverse, yet balanced, ecosystem that flourished for tens of thousands of years. Natural disturbances were part of that delicate balance which resulted in constant change to the landscape; hence, the perpetual cycle of natural succession was the driving force behind the diversity of species. These species, whether terrestrial or aquatic, were extremely resilient and barring catastrophic natural events, extinctions or extirpations were few and far between. That is of course, until recent times.

It is well documented that Native Americans helped perpetuate disturbance through the periodic use of fire. Whether or not their ecological contributions were meant for the betterment of the ecosystem or simply to flush game to the arrow or spear, their actions appeared to do little to upset the balance of nature. Much of that changed, however, with the coming of the European settlers in the 1600s. In a little over four centuries, a mere instant in geologic time, the balance of nature shifted. Many of the stresses placed on wildlife appeared when habitats were modified, or natural succession was "frozen in time". The agricultural revolution created town-sized monocultures of unchanging, unnatural vegetation while the "Smokey the Bear" era created huge expanses of even-aged, over-stocked forests that became increasingly unproductive for many native species.

The aquatic world was also not immune to extreme ecological disturbances. The Industrial Revolution and the ever-increasing need for energy resulted in the creation of the Tennessee Valley Authority (TVA) and the rapid proliferation of hydro-electric dams. TVA and U.S. Army Corps of Engineers (USACE) reservoirs now lay where free-flowing streams once meandered. In West Tennessee slow, winding streams were channelized for irrigation and improved agricultural production. Some say modern man's impact on wildlife resources has been catastrophic, while others argue they are simply a part of nature's delicate web. Regardless of their position, all agree that modern man's contributions have tremendously impacted our wildlife resources.

To make sense and use of this plan, it was decided that the state's wildlife resources could not be managed for the past; rather, they must be managed for the present and future. Though historical documents reveal landscapes that were vastly different, it is impractical to think that we can return to the times when American bison roamed free in savannah-like areas on the Cumberland Plateau or when native bobwhite shot out from underfoot on every farm across the valley or when canoe length sturgeon were pulled from the Tennessee River. Instead, for the benefit of our wildlife resources, we need to focus on what we have, what we can save, and in rare instances, what we can restore.

The "Field of Dreams" Approach:

Much like the famous saying in the award-winning movie "Field of Dreams," wildlife management uses the same mantra in that, "If you build it, he will come."

In the world of wildlife, the "it" is the habitat, while the "they" are the species that thrive in those habitats. Thus, the Agency's core function of Wildlife Resource Management is changing its focus to a habitat-first strategy since habitat is the cornerstone of providing healthy populations of animals. Provided that public and private lands and waters can provide ample quality habitat, species should be self-supporting if given the proper protection.

In development of this plan, it was determined that Tennessee could be broken out into seven major "habitats". Those habitats are: Grassland, Forestland, Wetland, Karst, Streams & Rivers, Impoundments, and Urban. The following chapters will describe in greater detail the meaning and importance of those habitats for our wildlife resources. It was also determined that an additional chapter needed to be added for the multitude of extrinsic factors that affect wildlife populations. That too is described in greater detail and is equally important for the successful management of our wildlife.

Importance:

As stated earlier, the economic impact of wildlife in Tennessee is immense with almost 3 billion dollars spent annually on wildlife-related endeavors. Besides its enormous economic impact, it is argued that being in nature provides health benefits and an increased quality of life for all that partake, especially the younger generations (Louv 2005). Fortunately, the government of Tennessee recognizes the tremendously important role wildlife plays in everyday life and has mandated that, "...the agency shall be nonpartisan and shall place first and foremost the welfare of the wildlife and its environment in the agency's planning and decisions, and to encourage, by every appropriate means, the full development of the state's natural resources to the benefit of all citizens of Tennessee." Given the role and status wildlife plays in the everyday life of Tennessee citizens, there is no denying the important task set before the Agency in protecting and managing our valuable wildlife resources.

GRASSLANDS

Definition:

The term “Grassland” describes lands that are predominately native, perennial grass-dominated habitats intermixed with low woody vegetation (shrubs), forbs and varying percentages of bare ground. This chapter addresses the management of grasslands by focusing on six grassland habitat groups identified in the Tennessee State Wildlife Action Plan (TNSWAP).

GRASSLANDS AT A GLANCE

Habitat Groups	Prairie/Barrens Glade/Barrens Bald/Summit	Old Field Pasture Row Crop
Species	Native grassland ecological systems are among the most imperiled in Tennessee. Grassland ecological systems provide primary habitat for 74 Greatest Conservation Need species identified in the TNSWAP.	
Threats	Fire Suppression Agricultural Conversion Incompatible Grazing/Pasture Management Incompatible Row Crop Agricultural Practices Residential/Commercial Development	
Strategic Objectives	Maintain or increase acreage of native grassland and other early successional habitats to provide productive wildlife habitat. Maintain or increase acreage of marginal agricultural lands converted to native wildlife habitats on private lands.	

Prairie/Barrens

TNSWAP identified six individual grassland ecological systems that comprise the Prairie/Barrens habitat group (Table 1-1). In Tennessee, most Prairie/Barrens systems exist as small patch habitats within predominately forested areas and are represented by plant communities with open canopies, ranging from herbaceous-dominated barrens through savanna and woodland types. The Prairie/Barrens habitat group is also represented by larger grassland systems that are similar in composition to the tall-grass prairies of the Midwest - being dominated by tall species of grasses, forbs, and small trees. The Prairie/Barrens habitat group is also represented by "The Barrens" of the Southeast Highland Rim of Tennessee with a variety of relatively open habitats including prairie-like areas, as well as savanna woodlands with open ponds and other wetlands scattered throughout the landscape.

Glade/Barrens

TNSWAP identified seven individual grassland ecological systems that comprise the Glade/Barrens habitat group (Table 1-1). In Tennessee, Glade/Barrens systems are typically associated with shallow soils overlying either limestone or sandstone bedrock. They almost always include areas of exposed bedrock within vegetative coverage that ranges from herbaceous grass dominated landscapes to dry savanna woodland habitats. The most prominent example of the Glade/Barrens habitat group in Tennessee is found in the Nashville Basin, associated with underlying limestone geology. The vegetation of this system includes sparsely vegetated rock outcrops, perennial grasslands, as well as woodlands dominated by eastern red cedar - hence the common referral to these systems as “cedar glades”. A similar Glade/Barrens system is found primarily on the Cumberland Plateau and is associated with underlying sandstone geology. In this setting eastern red cedar is replaced by various scrub oaks on sparsely vegetated sandstone rock outcrops.

Bald/Summit

This habitat group is represented by two ecological systems in Tennessee (Table 1-1). The Southern Appalachian Grass and Shrub Bald ecological system consists of dense herbaceous and shrubland communities in the highest elevation zone of the southern Appalachians. Vegetation consists either of dense shrub-dominated areas (heath balds) or dense herbaceous cover dominated by grasses or sedges (grassy balds). The Southern Appalachian Rocky Summit ecological system represents treeless rock outcrops of the southern Appalachian Mountains, primarily in western North Carolina and eastern Tennessee. The vegetation component of this system is generally characterized by a mixture of low-growing lichens, mosses, and low shrubs.

Old Field

The Old Field habitat group refers to lands that are recovering from disturbance such as timber harvest, agriculture, pasturing, mining, and other disturbances that remove the original plant cover. These are transitional open lands and in Tennessee most will ultimately become forest if not regularly disturbed. Old field succession begins with establishment of a wide variety of forbs and grasses depending on the land use history of the site and proceeds to establishment of woody plants. Woody plant development proceeds to a scrub/shrub stage where woody plants begin to dominate the site. Eventually trees invade and the site develops into forest.

Pasture

This habitat group refers to lands that are being pastured by livestock or that are being used to produce hay. In Tennessee these pasture lands are typically vegetated with tame grasses – primarily cool season grasses such as fescue. The wildlife value of pasture lands is seriously compromised when managed solely for livestock grazing or hay production. When grazing or haying ceases on these lands they form an old field community as described above.

Cropland

This habitat group refers to lands cultivated for agricultural crops such as corn, soybeans, cotton, wheat, etc. Like pasture lands, the wildlife value of croplands is seriously compromised when managed solely for crop production. When cropping ceases on these lands they succeed to an old field community as described above.

History:

In Tennessee, native grassland communities were most prominent prior to European settlement. Native peoples burned the forests, for thousands of years, to create and maintain necessary grasslands and open woodlands for game animals and food producing plants. After European settlement, the frequency of the fires ended, and thick forests replaced open grasslands in many places. As farming became mechanized in the 20th century, land became more intensively farmed with the result that small patches of residual native grasslands and especially old fields became cultivated. The ultimate result of this land use was that historic grassland communities in Tennessee have been gradually replaced by forests and the remaining open lands in the state are predominately pasture, hay, and crop lands.

Importance:

Grassland ecological systems provide primary habitat for 74 Greatest Conservation Need (GCN) species identified in the TNSWAP. Native grassland ecological systems are among the most imperiled in Tennessee. In particular, grassland songbird populations are experiencing more severe declines than any other songbird guild in North America. Quality old field habitats are especially scarce and are critical to species such as northern bobwhite, turkey, deer, and numerous nongame species. Small open grassland communities such as glades and balds contribute to habitat diversity in extensive forested landscapes and provide essential habitat for many species that would not be present otherwise. Native grasses/grasslands are beneficial since they are long-lived, deep rooted, well adapted to poor soils and local soil types, drought tolerant, require less soil amendments in fertilizer and lime, and require less annual maintenance. They can provide increased benefit to agricultural producers due to their high-quality hay and forage for livestock and at the same time provide good wildlife habitat.

Additionally, grasslands have other environmental benefits such as carbon sequestration and soil erosion control. Aquatic habitat and water quality are improved as intact grasslands reduce runoff and increase infiltration - preventing sediments, fertilizers, animal waste, and pesticides from entering streams, rivers, and other water bodies.

Threats:

The top five threats identified by the TNSWAP for grassland habitat groups were: fire suppression, agricultural conversion, incompatible grazing/pasture management, incompatible row crop agricultural practices, residential/commercial development. Other threats identified by TNSWAP for grassland communities included: forest type conversion, incompatible mining practices, and invasive exotic species. Combined, these threats lead to strategic issues of direct loss of grassland habitats, fragmentation of existing grassland habitats, and degradation of existing grasslands as good wildlife habitat.

Table 1-1. Grassland habitat groups and associated natural ecological systems (TNSWAP)

GRASSLAND HABITAT GROUPS	NATURAL ECOLOGICAL SYSTEMS
Prairie/Barrens	1) East Gulf Coastal Plain Black Belt Calcareous Prairie and Woodland, 2) East Gulf Coastal Plain Jackson Plain Prairie and Barrens, 3) Eastern Highland Rim Prairie and Barrens, 4) Pennyroyal Karst Plain Prairie and Barrens, 5) Southern Ridge and Valley Patch Prairie, 6) Western Highland Rim Prairie and Barrens
Glade/Barrens	1) Appalachian Shale Barrens, 2) Central Interior Highlands Calcareous Glade and Barrens, 3) Central Interior Highlands Dry Acidic Glade and Barrens, 4) Cumberland Sandstone Glade and Barrens, 5) Nashville Basin Limestone Glade, 6) Ridge and Valley Calcareous Valley Bottom Glade and Woodland, 7) Southern and Central Appalachian Mafic Glade and Barrens
Bald/Summit	1) Southern Appalachian Grass and Shrub Bald, 2) Southern Appalachian Rocky Summit
Old Field	Not Applicable
Pasture	Not Applicable
Cropland	Not Applicable

Objectives:

1. Maintain or increase acreage of native grassland and other early successional habitats on TWRA controlled lands to provide productive wildlife habitat.
2. Maintain or increase acreage of marginal agricultural lands converted to native wildlife habitats on private lands.

OBJECTIVE 1 Maintain or increase acreage of native grassland and other early successional habitats on TWRA controlled lands to provide productive wildlife habitat.

Issue 1 Native grassland habitats are at risk of degradation.

Strategy 1 Conduct inventories of grassland species to measure function of existing grasslands

Strategy 2 Utilize burning techniques to reduce duff accumulation and woody vegetation

Strategy 3 Utilize soil disturbance to increase bare ground component in grasslands

Strategy 4 Utilize adequate techniques to prevent the encroachment of or eliminate exotic invasive plants

Strategy 5 Educate TWRA personnel on latest grassland management techniques involving fire, mechanical, or chemical treatments

Issue 2 Quantity of native grassland habitat is declining.

Strategy 1 Convert croplands on TWRA lands to quality grasslands where feasible

Strategy 2 Convert exotic pasture/hay lands on TWRA lands to quality grasslands where feasible

Strategy 3 Convert forestland on TWRA lands to quality savanna and grasslands where feasible

Strategy 4 Convert marginal and disturbed habitat on TWRA lands to quality grassland where feasible

OBJECTIVE 2 Maintain or increase acreage of marginal agricultural lands converted to native wildlife habitats on private lands.

Issue 1 Barriers exist for management of native grasslands on private lands.

Strategy 1 Work with partners (NRCS, TDEC, TNC, etc.) to enhance grassland habitat on lands not controlled by the Agency

Strategy 2 Work with partners to help educate private landowners in grassland management

Strategy 3 Develop programs that may encourage the maintenance or creation of native grasslands on private lands

FORESTLANDS

Definition:

The term “Forestland” describes land that is predominately covered by trees. However, forests are highly varied ecosystems that, from the forest floor to the forest canopy, support an incredibly complex web of life. This chapter addresses the management of forestlands by focusing on five upland forestland habitat groups identified in the Tennessee State Wildlife Action Plan (TNSWAP).

Upland Deciduous Forest

The Upland Deciduous Forest habitat group is the most extensive and diverse of the five forestland habitat groups in Tennessee.

TNSWAP identified thirteen individual forested ecological systems that comprise the Upland Deciduous Forest habitat group. Upland Deciduous Forests are often characterized as either xeric (dry) or mesic (wet), depending on moisture availability. In Tennessee, the more xeric deciduous forest types are typically found on upper slopes, especially those that are south and southwest facing. Xeric forest systems in Tennessee are commonly referred to as dry Oak-Hickory forests where oaks and hickories persist as dominant members of the forest due to drought tolerance and site conditions sufficient for regeneration of relatively shade-intolerant species. Mesic deciduous forest types are typically restricted to north and east facing slopes in mountainous parts of the state or in fertile lowlands of the coastal plain and central basin and are often referred to as cove or mixed-mesophytic hardwood forests.

Upland Coniferous Forest

TNSWAP identified three individual forested ecological systems that comprise the Upland Coniferous Forest habitat group (Table 1). The Central and Southern Appalachian Spruce-Fir Forest is a unique biotic community and the dominant forest type found almost exclusively at higher elevations in the Southern Blue Ridge Mountains. Southern Appalachian Low Mountain Pine Forest and Southern Appalachian Montane Pine Forest and Woodland systems are typically found in extreme conditions (i.e. xeric ridge-tops, poor soils) allowing pine species to dominate.

FORESTLANDS AT A GLANCE

Habitat Groups	Upland Deciduous Forest Upland Coniferous Forest Upland Mixed Forest Forested Rock Outcrop Forest Plantation
Species	Upland forest habitats support more species of wildlife than any other terrestrial habitat in Tennessee. Forestland ecological systems provide primary habitat for 173 Greatest Conservation Need species identified in the TNSWAP.
Threats	Residential/Commercial Development Construction of Roads and Utilities Agricultural Conversion Incompatible Forestry Practices Invasive Exotic Species
Strategic Objectives	Manage lands to attain desired forest conditions that provide productive wildlife habitat. Protect key ecological features found within forest communities.

Upland Mixed Forest

TNSWAP identified two individual forested ecological systems that comprise the Upland Mixed habitat group (Table 1). Like spruce-fir forest systems in the Southern Blue Ridge Mountains, Appalachian Hemlock-Hardwood forest is another unique habitat group that occupies a small niche within a larger forest matrix. It is often associated with gorge and ravine systems and in many cases has a close association with riparian systems. As such, it supports a diverse biotic community of both aquatic and terrestrial species. The East Gulf Coastal Plain Interior Shortleaf Pine –Oak Forest system primarily occupies xeric and semi-mesic sites and vegetation composition is strongly related to fire frequency and intensity.

Forested Rock Outcrop

TNSWAP identified 10 individual forested ecological systems that comprise the Forested Rock Outcrop habitat group (Table 1). These small patch systems are imbedded features within the overall forest matrix provided by the preceding habitat groups. As such, they range from xeric cliffs, bluffs, and talus slopes to mesic gorge and riparian situations. These small patch habitats are predominantly found within the Cumberland Plateau and Mountains and Southern Blue Ridge physiographic regions and provide for much of the diversity within larger forestlands.

Forest Plantation

The Forest Stewardship Council describes forest plantations as “forest areas lacking most of the principal characteristics and key elements of native ecosystems, which result from the human activities of planting, sowing or intensive silvicultural treatments,” and the Society of American Foresters defines a plantation as “a stand composed primarily of trees established by planting or artificial seeding.” Likewise, TNSWAP identified Forest Plantations as a semi-natural habitat, denoting that this habitat type exists because of human activities on the landscape. In Tennessee, forest plantations primarily consist of coniferous species planted by forest industry. Industrial plantations are actively managed for the commercial production of forest products, are usually large-scale and consist of even-aged management of one species. The trees used for plantations are often genetically altered for desired traits such as growth and resistance to pests and diseases. Plantation management and goals dictate the diversity of plantation forests and their value to wildlife.

History:

Forestlands have always been a predominant feature on the Tennessee landscape. However, they are dynamic in nature, often changing in response to a variety of disturbances including climate change, insect pests and disease, fire, and human activities. The history of forestland habitats in Tennessee reflects this dynamic nature.

Tennessee forestlands have been shaped by the dramatic changes in climate associated with major glacial periods (ice-ages). During peak glacial periods, Tennessee forestlands resembled the boreal forests found today in more northern climes and were dominated by coniferous tree species including spruces, firs, and pines. As glacial periods declined and the climate warmed, deciduous forestlands became dominant on the landscape with pockets of boreal elements (spruce-fir forest) remaining at high elevations in the Appalachian Mountains.

Contrary to popular belief, the New World, including the Southeast and Tennessee, was not a pristine wilderness prior to European settlement. Native American use of fire in land management significantly affected the structure of forest stands and the relative abundance of tree species over large portions of the region. Early white settlers adopted these same practices - burning the forests as well as clearing them for agriculture. These activities resulted in open habitats such as savannas, barrens, and prairies, scattered within the overall forestland in Tennessee at the time.

At the turn of the 20th century, the logging industry in Tennessee was producing lumber at its historical peak, with large tracts of forest being clear-cut to supply the ever-growing demand for forest products. In addition, forests were converted to agricultural fields and pastures and large areas were cleared in strip mining operations. As a result, Tennessee's forests and forestlands were diminished in area, productivity, and quality. However, this gross over-exploitation of the state's and nation's forest resources was cause for the growing alarm that gave birth to the conservation movement, resulting in the establishment of state and national parks, forests, wildlife management areas and reserves. An additional factor that helped restore Tennessee's upland forests in the 20th century was the abandonment of farming by many who left to find work in the city, and the consequent return of fields and pastures to forestland.

Another milestone in the history of Tennessee's forests was the emergence of the pine pulp industry in the early 1950's. This created a greater market for pines and low-value hardwoods and resulted in the conversion of thousands of acres of hardwood-dominated forests into pine plantations to supply the paper industry.

According to the latest Forest Inventory and Analysis report, in 2019, forests covered nearly 53 percent, or slightly greater than 14 million acres, of the land base in Tennessee. Only about 5 percent of the pre-settlement old-growth forest on the Cumberland Plateau remains, and no more than 20 percent of the forest of Tennessee's Blue Ridge Province can be classified as old growth. Those few tracts of old growth not on public land are mostly in fragments of 100 acres or less. Most of the forest types classified as old growth today are second or third-growth forests that have or are developing the structural characteristics of old growth. On TWRA managed lands approximately 85% of all lands owned (500,000 acres) and controlled (1.5 million acres) by TWRA are forested, proper management of forestlands offer a tremendous tool to impact and improve wildlife habitat.

Importance:

Upland forest habitats support more species of wildlife than any other terrestrial habitat in the state. Forestland ecological systems provide primary habitat for 173 Greatest Conservation Need species

identified in the TNSWAP. While some species are permanent residents and depend on the forest throughout their entire lives, other species only utilize the forest during certain times of their annual life cycle. The diversity within upland forests provide a tremendous variety of food and water resources as well as habitats for breeding, post-breeding dispersal, and migratory and/or over-winter sites.

The ability of upland forests to support a great diversity of wildlife is due in part to the variety of different habitats and niches found within a structurally diverse forest system. A biologically and ecologically functional upland forest contains a heterogeneous vegetation structure with varying levels of canopy closure and basal area of canopy trees that results in diverse understory and mid-story communities. Diverse and structurally complex upland forests provide for thousands of species of plants, animals, and fungi, including many rare and threatened species.

Upland forests benefit citizen stakeholders in a variety of direct and indirect ways. Direct benefits of managing and maintaining upland forests include opportunities for residents to participate in hunting and fishing, wildlife viewing, hiking, and other outdoor recreational activities. Indirect benefits of upland forests include reducing soil runoff which maintains higher water quality in bodies of water ranging from ephemeral and first order streams to the larger lakes and rivers across the state. Forests also filter pollutants and improve water absorption and retention, which increases groundwater recharge. Forest cover influences local temperatures, improves air quality, and, may play an important role in mitigating climate change via carbon sequestration. Upland forests also provide income and jobs by providing a variety of timber products and related management activities.

Threats:

The top five threats identified by the TNSWAP for upland forest habitats were: residential/commercial development, construction of roads and utilities, agricultural conversion, incompatible forestry practices, and invasive exotic species. Other significant threats identified by TNSWAP for forestland ecological systems included forest type conversion and incompatible mining practices. Combined, these threats contribute to strategic issues of direct loss of forestland habitats, forest fragmentation, and degradation of forestland habitat for wildlife.

Table 1. Forestland habitat groups and associated natural ecological systems (TNSWAP)

FORESTLAND HABITAT GROUPS	NATURAL ECOLOGICAL SYSTEMS
Upland Deciduous Forest	1) Allegheny-Cumberland Dry Oak Forest and Woodland, 2) Southern Appalachian Northern Hardwood Forest, 3) East Gulf Coastal Plain Limestone Forest, 4) East Gulf Coastal Plain Northern Dry Upland Hardwood Forest, 5) East Gulf Coastal Plain Northern Loess Bluff Forest, 6) East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland, 7) East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest, 8) South-Central Interior / Upper Coastal Plain Flatwoods, 9) South-Central Interior Mesophytic Forest, 10) Southern Interior Low Plateau Dry-Mesic Oak Forest, 11) Southern and Central Appalachian Cove Forest, 12) Southern Appalachian Oak Forest, 13) Southern Ridge and Valley / Cumberland Dry Calcareous Forest
Upland Coniferous Forest	1) Central and Southern Appalachian Spruce-Fir Forest, 2) Southern Appalachian Low-Elevation Pine Forest, 3) Southern Appalachian Montane Pine Forest and Woodland
Upland Mixed Forest	1) Appalachian (Hemlock)-Northern Hardwood Forest, 2) East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest
Forested Rock Outcrop	1) Allegheny-Cumberland Sandstone Box Canyon and Rockhouse, 2) Central Interior Acidic Cliff and Talus, 3) Central Interior Calcareous Cliff and Talus, 4) Cumberland Acid Cliff, 5) North-Central Appalachian Acidic Cliff and Talus, 6) North-Central Appalachian Circumneutral Cliff and Talus, 7) Southern Appalachian Montane Cliff & Talus, 8) Southern Appalachian Spray Cliff, 9) Southern Interior Calcareous Cliff, 10) Southern Interior Sinkhole Wall
Forest Plantation	Not Applicable

Objectives:

1. Manage TWRA controlled lands to attain desired forest conditions that provide productive wildlife habitat.
2. Protect key ecological features found within forest communities.

OBJECTIVE 1 Manage TWRA controlled lands to attain desired forest conditions that provide productive wildlife habitat.

Issue 1 Forest monocultures, even-aged, over-stocked forests, and other forests in poor condition due to lack of management provide marginal wildlife habitat.

Strategy 1 Conduct inventories of upland forest species to measure function of existing forests

Strategy 2 Implement forest inventory and develop forest management plans to assess, restore, improve, and/or create native upland forest systems

Strategy 3 Implement silvicultural treatments to improve wildlife habitat, through thinning (commercial or pre-commercial), forest regeneration, and/or prescribed fire that influence stocking rate, increase structural diversity, and enhance regeneration of desirable tree species and other vegetation

Strategy 4 Increase or maintain key elements of stand structural complexity, i.e. hollow/den trees, snags, downed woody debris, understory thickets, mid-story structure

Strategy 5 Develop and implement monitoring programs to assess usage by wildlife, i.e. bird counts, within forest stands being managed to restore, improve and/or create native upland forest systems

Strategy 6 Continue working with partner agencies and organizations to promote implementation of forest and wildlife habitat management based on biological and ecological principals, on both private and public lands

Strategy 7 Cooperate with planning efforts and support and promote existing programs that improve forest habitat through technical support and financial assistance

Strategy 8 Utilize partnerships and other affiliations to influence forest lands management policy and program decision-making and funding at the local, regional, and national level

OBJECTIVE 2. Protect key ecological features found within forest communities.

Issue 1 Many Greatest Conservation Need (GCN) species utilize limited, local, or specialized habitats within the forest.

Strategy 1 Increase or maintain buffers to rock outcrops and other key ecological features during management activities

Strategy 2 Increase or maintain key elements of stand structural complexity (i.e. hollow trees, down woody debris, understory thickets, mid-story structure)

Strategy 3 Improve or maintain habitats of fire dependent GCN species through use of prescribed fire

Issue 2 Lack of forest connectivity across the landscape limits wildlife population sustainability and expansion.

Strategy 1 Identify focal areas for conservation of upland forests; use all available partnerships, planning tools, and technologies to identify areas of common interest where partners can pool resources to benefit forest and wildlife resources most efficiently

Strategy 2 Target land acquisition, easement opportunities, and landowner outreach efforts in strategically identified conservation focal areas

Strategy 3 Foster relationships with partners to facilitate planning and funding for land acquisition and sustainable forest habitat management

Strategy 4 Target restoration efforts of native upland forest systems in areas in need of conservation

Strategy 5 Increase use of planning tools (such as Joint Venture (JV) and other landscape cooperative modeling, to identify and address potential impacts of climate change, urbanization, and low-density development on GCN and other priority species in upland forest communities

WETLANDS

Definition:

Wetlands may be defined as low-lying areas of land that are saturated with moisture, often with standing water, especially when regarded as the natural habitat of wildlife.

Floodplain forests, swamps, marshes, bogs, forest seeps are all examples of wetlands found in Tennessee. This chapter addresses the management of wetlands by focusing on three wetland habitat groups identified in the Tennessee State Wildlife Action Plan (TNSWAP).

WETLANDS AT A GLANCE

Habitat Groups	Riparian Wetlands Isolated Wetlands Converted Wetlands
Species	in Tennessee more than 90% of our historic wetlands have been lost. Wetland ecological systems provide primary habitat for 97 Greatest Conservation Need species identified in the TNSWAP.
Threats	Agricultural Conversion Residential/Commercial Development Construction of Ditches/Dikes/Drainage/Diversion Systems Incompatible Row Crop Agricultural Practices Incompatible Forestry Practices
Strategic Objectives	Maintain or increase acreage of wetland habitats. Manage wetlands to provide productive wildlife habitat.

Riparian Wetlands

TNSWAP identified eight individual riparian wetland ecological systems that comprise the Riparian Wetlands habitat group (Table 1-3). The most extensive riparian wetland habitats in Tennessee are bottomland hardwood floodplain forests that occur along small streams and broad river bottoms in West Tennessee. These wetland ecosystems support unique forest communities of bald cypress, water tupelo, black gum, and numerous species of oak, as well as a variety of other deciduous tree species. Moving east across the state, forest communities encompassing riparian wetland habitats become more variable as streams and rivers flow through various forested ecological systems. Another unique wetland floodplain habitat occurs along high gradient streams and in river gorges of East Tennessee. Forest communities that are found in these riparian wetland ecosystems include a tree and shrub species mix of eastern hemlock, white pine, rhododendron, mountain laurel, and various hardwood tree species.

Isolated Wetlands

TNSWAP identified six individual isolated wetland ecological systems that comprise the Isolated Wetlands habitat group (Table 1-3). These isolated wetland ecological systems exist as small patch habitats within predominately forested areas. Forested seeps, swamps, and wet flatwoods most often occur in stream head swales or on broad sandstone or limestone ridges where soils are saturated due to a combination of perched water table and seepage flow. Examples of seeps and swamps range in condition from open woodlands to forests, and some may lack a canopy and then will be dominated by shrubs or herbs. Bog wetlands in Tennessee are associated with flat sites in the Southern Blue Ridge and Cumberland Mountains. These sites occur at elevations below 1220 m (4000 feet) in poorly drained bottomlands on soils which are often saturated. Vegetation is a complex of vegetative zones – at least partially open, with herbaceous-dominated areas as well as shrub thickets and often forested zones.

Converted Wetlands

The Converted Wetlands habitat group represents wetland habitats that have either been converted or altered to accommodate other land use activities. In Tennessee these are most commonly wetlands that have been drained, dredged, filled, leveled, or otherwise manipulated for the purpose of producing an agricultural commodity. Wetlands may also be altered to accommodate development – both residential and commercial/industrial development. In almost all cases where wetlands are converted and/or altered the benefit of the wetland as wildlife habitat is degraded.

History:

Wetlands are one of the most critically imperiled habitats in the United States. In Tennessee, more than 90% of our historic wetlands have been lost, primarily due to draining for agriculture or development. This includes eighty percent of bottomland hardwood wetland forests in the Mississippi Alluvial Valley of Tennessee and other southern states that were converted to agricultural lands by 1978. In 1986 an international plan was developed to manage habitat across this vast landscape. The North American Waterfowl Management Plan (NAWMP) is a partnership of federal, provincial/state, and municipal governments, non-governmental organizations, private companies, and many individuals. All these organizations are working towards achieving better wetland habitat for the benefit of migratory birds, other wetland-associated species, and people.

In 1986, Tennessee's Legislature enacted the "Tennessee Wetland Acquisition Act" which authorizes TWRA to acquire wetlands containing hydric soils, a dominance of obligate hydrophytes and bottomland hardwood forest. Funding for the Tennessee Wetland Acquisition Act is derived from a portion of the Property Transfer Tax. TWRA has acquired over 200,000 acres through the Wetland Acquisition Fund and continues to use the fund in acquiring and maintaining important habitat.

Shortly thereafter, TWRA initiated strategic efforts to restore, protect, and enhance wetland habitat across the state that continue to this day. The federal government has been our most significant financial partner for the restoration of wetlands by providing more than \$4 million for wetland projects. Ducks Unlimited has also been a major partner with Tennessee by providing cash and in-kind services (estimated at almost \$1 million) for about 30 completed wetland projects.

Importance:

Wetland ecological systems provide primary habitat for 97 Greatest Conservation Need species identified in the TNSWAP. Where wetland ecological systems are present on the landscape, they are an integral part of the life cycle of most wildlife species. While some species are permanent residents and depend on wetlands throughout their entire lives, other species only utilize wetlands during certain times of their annual life cycle. Wetlands are especially critical habitat for waterfowl and shorebird species. The diversity within wetland ecosystems provide a tremendous variety of food and water resources as well as habitats for breeding, post-breeding dispersal, and migratory and/or over-winter sites for both waterfowl and shorebirds in Tennessee.

Wetlands provide many environmental and economic benefits to the citizens of Tennessee. Wetlands enhance water quality by removing sediments and other pollutants from surface water. Wetlands also provide for groundwater recharge - ensuring that clean quality groundwater is available for the future. Recreational opportunities provided by wetlands include hunting, fishing, hiking, boating, etc. that not only add to the quality of life, but also have a significant economic impact on the state.

Threats:

The top five threats identified by the TNSWAP for the Wetlands habitat group were: agricultural conversion, residential/commercial development, construction of ditches/dikes/drainage/diversion systems, incompatible row crop agricultural practices, and incompatible forestry practices. Other threats identified by TNSWAP for wetland ecological systems included incompatible grazing/pasture management practices, and construction of roads/railroads/utilities. Combined, these threats contribute to the strategic issues of direct loss of wetland habitat and the degradation of existing wetlands as good wildlife habitat.

Table 1-3. Wetland habitat groups and associated natural ecological systems (TNSWAP)

WETLAND HABITAT GROUPS	NATURAL ECOLOGICAL SYSTEMS
Riparian Wetlands	1) Cumberland River scour, 2) East Gulf Coastal Plain Large River Floodplain Forest, 3) East Gulf Coastal Plain Northern Seepage Swamp 4) East Gulf Coastal Plain Small Stream and River Floodplain Forest, 5) Lower Mississippi River Bottomland and Floodplain Forest, 6) Lower Mississippi River Bottomland Depressions, 7) South-Central Interior Large Floodplain, 8) South-Central Interior Small Stream and Riparian
Isolated Wetlands	1) Central Interior Highlands and Appalachian Sinkhole and Depression Pond, 2) Cumberland Seepage Forest, 3) South-Central Interior / Upper Coastal Plain Wet Flatwoods, 4) Southern and Central Appalachian Bog and Fen, 5) Southern Appalachian Seepage Wetland, 6) Western Highland Rim Seepage Fen
Converted Wetlands	Non-Applicable

Objectives:

1. Maintain or increase acreage of wetland habitats.
2. Manage wetlands on TWRA controlled lands to provide productive wildlife habitat.

OBJECTIVE 1. Maintain or increase acreage of wetland habitats.

Issue 1 Wetland habitats are at risk of degradation.

Strategy 1 Conduct inventories of wetland species to measure function of existing wetlands

Strategy 2 Restore, enhance, or create wetlands on lands TWRA already owns or controls

Strategy 3 Continue restoration of bottomland hardwood forests on former agricultural lands through artificial and natural regeneration methods, at current rate or higher, to achieve objectives of the West Tennessee Wildlife Resources Conservation Plan (see Forestland, Objective 2, Issue 2, and associated strategies)

Strategy 4 Utilize real estate data to determine how many acres of current wetlands are under TWRA control and determine where additional wetlands are needed by identifying habitat goals in various regional plans (i.e. NAWMP, JV, etc.)

Strategy 5 Support non-Agency programs that promote wetland restoration, enhancement, creation, and protection where appropriate and feasible

Opportunity 1 Funding sources are available to purchase wetland habitats.

Strategy 1 Utilize and leverage the Wetland Fund and associated grant opportunities to support TWRA regional wetland objectives

Strategy 2 Cultivate relationships with funding partners to support TWRA regional wetland objectives

OBJECTIVE 2 Manage wetlands on TWRA controlled lands to provide productive wildlife habitat.

Issue 1 Barriers exist for management of wetlands to provide productive wildlife habitat.

Strategy 1 Manage current wetlands to meet existing JV habitat goals for wetland birds and habitat requirements for wetland dependent GCN species as identified in the TNSWAP where feasible

Strategy 2 Investigate managing for more moist-soil habitat on refuges to provide benefits to waterfowl and GCN species as identified in the TNSWAP where feasible

Strategy 3 Plant more hydric soil tolerant crops (millet, rice, chufas) instead of dry crops (corn, milo) to benefit a broader range of wetland wildlife

Opportunity 1 Regulations, partners, and permitting processes are in place to ensure wetland acquisition and mitigation maintains ecological integrity.

Strategy 1 Support wetland protection through the enforcement of regulations, acquisition, and the placement of easements to maintain ecological integrity of identified wetlands

Strategy 2 Seek partners willing to assume long-term management responsibility of acquired sensitive wetlands

KARST

Definition:

Landforms produced primarily through the dissolving of rock, such as limestone, dolomite, marble, and gypsum, are collectively known as karst. Features of karst landscapes include sinkholes, caves, surge springs, dry valleys and sinking streams (Veni et al. 2001). This chapter focuses on these “features”; however, the primary emphasis is on caves and the wildlife that utilize them. Tennessee subterranean regions extend from the Tennessee River in the western part of the state to the Southern Blue Ridge Mountains in the east (Figure 1-1). With more than 9,000 documented caves, Tennessee has

more caves than any other state in the country. These regions do not however have an even distribution of caves. The region with the highest density of caves is the Cumberland-Rim (Cumberland Escarpment –Eastern Highland Rim, Cumberland Plateau and Southern Cumberland Sequatchie Valley sub-regions) (Figure 1-2). Caves and karst were included in the TNSWAP and the TWRA participated in a subsequent Nature Conservancy (TNC) planning process to refine the karst section of TNSWAP. The protection of caves and cave dwelling wildlife is a high priority for the TWRA.

History:

Humans have been using Tennessee caves for a very long time. In the Archaic period, caves were explored, mined, and decorated with art. The same range of activities occurred during the Woodland Period, with the probable use of pit caves for burial. The mining of mineral salts was also an emphasis. Mississippian peoples decorated caves and may have performed limited mining. In the 19th century (War of 1812 and Civil War), saltpeter was mined to produce gunpowder. Caves have been used as tourist attractions since the early and mid-20th century and today you can go see a bluegrass show at Cumberland Caverns in McMinnville or tour the underground lake at the Lost Sea in Sweetwater. Caving (or spelunking) is a recreational pursuit with a rich tradition with several grotto clubs across the state. The Tennessee Cave Survey, Inc. (TCS) is an internal organization of the National Speleological Society (NSS) dedicated to surveying and mapping of Tennessee caves. With the cave resources found in Tennessee it is no surprise that people come from all parts of the country to visit these sites.

CAVES AND KARST AT A GLANCE

Habitat Features	Caves Sinkholes Surge Springs	Dry Valleys Sinking Streams
Species	Tennessee has more caves than any other state in the country. Cave and karst ecological systems provide habitat for many Greatest Conservation Need species identified in the TNSWAP.	
Threats	Pollution from Surface Activities Alteration of Hydrology Incompatible Recreational Use Invasive Exotic Species	
Strategic Objectives	Protect and restore ecological integrity of karst resources. Protect and restore karst dependent species or communities.	

Importance:

Tennessee caves provide habitat for a globally significant wildlife resource. Tennessee has several cave dwelling bats. Some of these bats use caves for hibernation only and some use them year-round for summer and winter habitat. Half of the bats that inhabit Tennessee utilize caves. While some animals such as bats are seasonal or daily visitors to caves many are uniquely adapted for living in an environment devoid of light. There are fish, crayfish, shrimp, isopods, arachnids, and beetles that are adapted to live in caves. These animals have no eyes, often lack pigment, and have long antennae and legs. Like the surface world, there are aquatic fauna (stygobitic) and terrestrial fauna (troglobitic). Because these systems are isolated there is a high degree of endemism associated with cave fauna. This endemism greatly enhances Tennessee's biodiversity. There is also potential for caves to serve as refugia for terrestrial fauna such as salamanders during dry periods. Species such as long-tailed, slimy, northern red and cave salamanders are often encountered in caves. There is no doubt that we are still learning about the ecological significance and diversity associated with caves.

To understand the importance of karst systems, many municipalities in Tennessee rely on springs for their water supply. Ground water produced from wells and springs in Middle and East Tennessee and from wells in West Tennessee provides 36 percent (about 321 Mgal/d) of the public water supplies. Springs in Middle and East Tennessee provided about 14 percent (about 42 Mgal/d) of ground-water supplies used in the State (USGS, 2003).

Threats:

Threats to wildlife in caves include pollution from surface activities, alteration of hydrology, incompatible recreational use, and invasive exotic species. Combined, these threats lead to strategic issues of degradation of existing cave and karst ecological systems and imperilment of wildlife species utilizing cave and karst features.

Figure 1-1. Tennessee karst regions and sub-regions

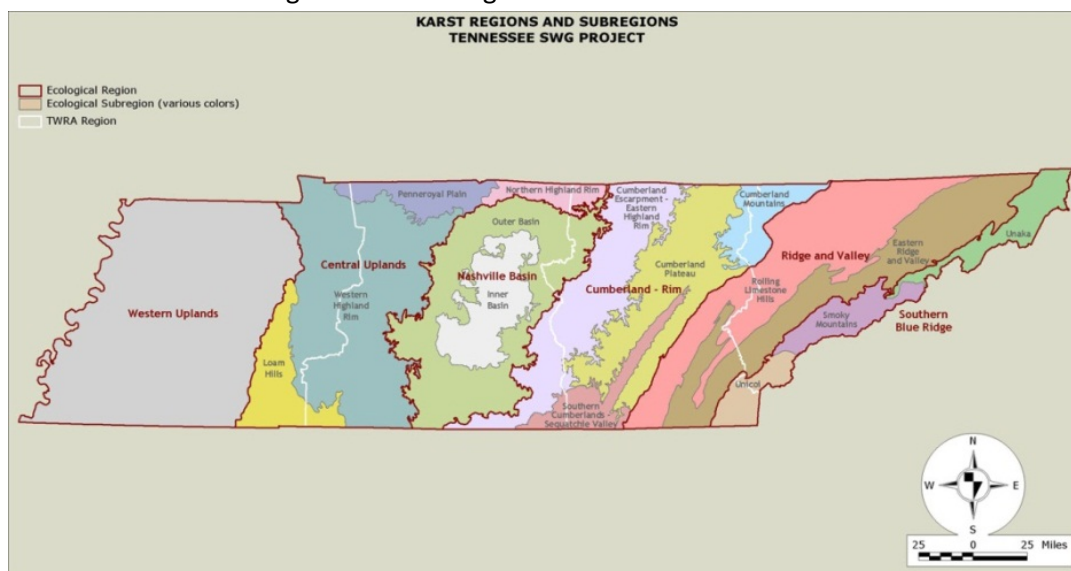
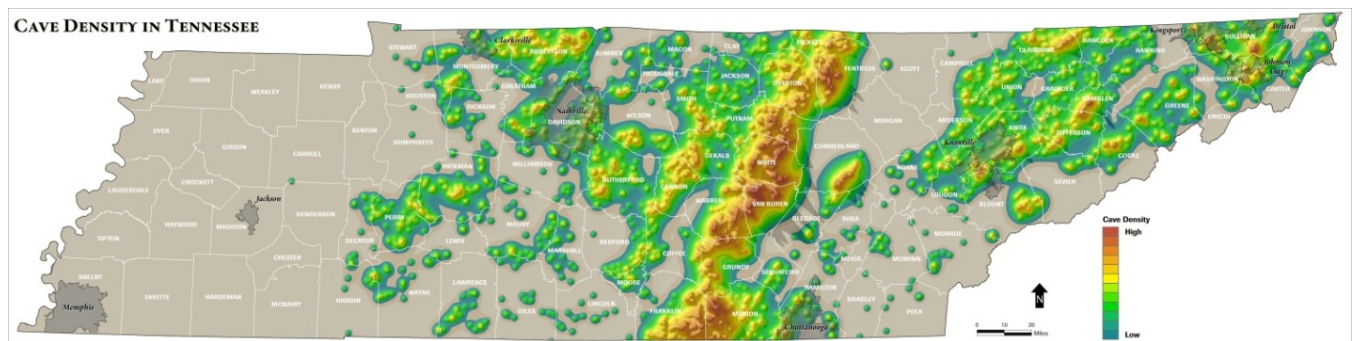


Figure 1-2. Patterns of cave density in Tennessee



Objectives:

1. Protect and restore ecological integrity of karst resources.
2. Protect and restore karst dependent species or communities.

OBJECTIVE 1 Protect and restore ecological integrity of karst resources.

Issue 1 Incompatible land-use practices and human activities can have negative impacts on karst ecosystems.

Strategy 1 Include karst resources in environmental reviews

Strategy 2 Incorporate karst resources in lands management planning

Strategy 3 Determine appropriate use levels in caves

Strategy 4 Discourage inappropriate use in caves

Strategy 5 Develop recreational plans

Strategy 6 Manage research efforts to minimize impacts on cave ecosystems

OBJECTIVE 2 Protect and restore karst dependent species or communities.

Issue 1 The biodiversity contained in karst systems is poorly understood.

Strategy 1 Identify and engage key partners to assist with karst conservation projects

- Strategy 2 Determine needs and leverage funding for karst research through grants and partnerships
- Strategy 3 Responsibly increase inventory and research efforts through Agency and partnering organization efforts
- Strategy 4 Maintain existing monitoring projects and identify future monitoring needs
- Opportunity 1 Many caves in Tennessee provide habitat for unique and globally significant communities that can benefit from protection and restoration actions.
- Strategy 1 Identify cave locations and determine level of use
- Strategy 2 Acquire priority karst habitat
- Strategy 3 Support exclusion gating at priority caves
- Strategy 4 Support research that benefits cave dependent species
- Strategy 5 Support karst clean-up projects

STREAMS AND RIVERS

Definition:

Streams and rivers are waters that flow across the landscape within channels. Streams and rivers are categorized by size based on an order system in which smaller systems converge to form larger ones. Two first order streams (the smallest) converge to form a second order stream, two second order streams converge to form a third order stream, and so on. When a smaller stream converges with a larger (higher order) stream, order does not change below the confluence. For this chapter, streams and rivers will be categorized as headwaters/small streams (orders 1-3), medium rivers (orders 4-6), and large rivers (orders >6). We will also address two special classifications (channelized rivers and tailwaters) that differ in ecological function because of altered hydrology.

Headwaters/Small Streams

Headwaters and small streams are the origins of larger streams and rivers and are usually associated with higher elevations. These waters are characterized by typically low productivity, highly variable habitat conditions, and low species richness.

Medium Rivers

Medium-sized rivers are found in each physiographic region of Tennessee and make up most of the flowing water. These water bodies are typically more productive than headwater streams and are likely home to the greatest number of species.

Large Rivers

There are three large river systems in Tennessee: the Mississippi, the Tennessee, and the Cumberland. The Mississippi River (10th order) is the largest riverine ecosystem in North America and the third largest in the world. This dynamic, large-flood-plain river ecosystem flows 167 miles along Tennessee's western border. Over 45% of the Tennessee River's 886 miles flow through both eastern and western Tennessee and it is the largest tributary of the Ohio River. The Cumberland River is also a tributary of the Ohio River and a similar proportion of its 686 miles flow through the northern section of middle Tennessee. Much of the riverine habitat in the Tennessee and Cumberland rivers was converted to reservoirs with the construction of dams during the early 20th century. Despite their impoundment, these two systems still have valuable riverine sections in the upper ends of most reservoirs.

STREAMS AND RIVERS AT A GLANCE

Habitat Categories	Headwaters/ Small Streams Medium Rivers Large Rivers
Classifications	Channelized Rivers Tailwaters
Species	Tennessee streams are home to more species of fish (325) and mussels (460) than any other state in the country. The highly diverse streams of Tennessee provide habitat for 244 Greatest Conservation Need species identified in the TNSWAP.
Threats	Pollution Alteration of Hydrology Incompatible Recreational Use Increased Withdrawals Invasive Exotic Species
Strategic Objectives	Maintain and restore stocks of desired aquatic species. Protect and restore the ecological integrity of streams and rivers.

Channelized Rivers

Channelization of streams and rivers is the alteration of the natural flow by straightening their naturally winding courses across the landscape. This process has occurred on every size stream in Tennessee, mostly for the purpose of protecting land from flooding (e.g. to gain land for agricultural production). This results in increased current velocities, increased down cutting of the channel, decreased bank stability, loss of habitat, and poor water quality.

Tailwaters

Tailwaters are the river segment below water control structures, such as hydroelectric dams, that have altered flows, habitats, and water quality. In Tennessee, the construction of hydroelectric dams on medium to large rivers has affected the natural riverine habitat to the extent that native fish assemblages may be altered or are no longer present. Where native sportfish populations have been substantially reduced or eliminated, suitable non-native species have been introduced to provide recreational fishing opportunities.

History:

Historically, the landscape of Tennessee has been dominated by streams and rivers that have, over millions of years, sculpted out six physiographic regions that provide a diversity of aquatic habitats and fauna. These six physiographic regions (Mississippi Alluvial Plain, Upper Gulf Coastal Plain, Interior Low Plateau, Cumberland Plateau & Mountains, Ridge & Valley, and Southern Blue Ridge) encompass five independent river drainages or aquatic regions (Mississippi River, Tennessee River, Cumberland River, Barren River, and Conasauga River).

Since the time of the first human habitation of Tennessee by Paleo-Indians, streams and rivers have served as water sources for people and crops, routes of travel and trade, and supplied sources of food and raw materials for civilizations. Native Americans settled along many of the rivers throughout Tennessee and began altering the landscape along the rivers by clearing lands with fire to create open areas for wildlife and subsistence farming. Early European settlers adopted these same practices of clearing land for agriculture. Some of the first permanent European settlers to Tennessee developed a settlement in the Watauga River valley of east Tennessee in 1769. By 1779, the European settlers had moved westward into the Cumberland River valley, and by the early 1800's the landscape was being altered greatly by their agricultural practices, building of settlements, and development of routes for transportation.

At the turn of the 20th century, the commercial harvest of timber began to drastically alter the landscape of Tennessee as large amounts of forest were cleared to meet the demand for wood products. In addition to the deforestation from agricultural practices and timber harvest, mining of iron ore, coal, lead, zinc, copper, manganese, and phosphate, severely transformed many of the watersheds draining into Tennessee's streams and rivers. As a result of all the landscape changes, many of Tennessee's streams and rivers received massive amounts of sediment and pollutants that devastated habitat or completely extirpated aquatic fauna.

Another time of great change for Tennessee's streams and rivers was the passage of the Tennessee Valley Authority (TVA) Act of 1933. This formed a federally owned corporation to improve navigability, provide flood control, reforest, and improve marginal farmland, assist in industrial and agricultural development, and assist in the creation of a government nitrate and phosphorus production facility within the Tennessee Valley region. The modernization of the Tennessee Valley began with the construction of 16 hydroelectric dams and a coal fired steam plant between 1933 and 1944. Agricultural programs developed by TVA began to address some of the issues with land erosion and sedimentation of streams and rivers. Today, TVA operates dams at 47 reservoirs, 19 fossil fuel power plants, and 3 nuclear power production facilities. While these projects have benefited the Tennessee Valley, they have also changed streams and rivers by creating large reservoirs that fragment rivers, altering flow regimes and water quality.

Just as damaging to river ecosystems as dams, channelization of rivers in west Tennessee throughout the 19th and 20th centuries forever changed the landscape there. Channelization, used primarily for flood control and agricultural production, allowed for the movement of coarse sediments from uplands, gullies, and associated tributaries into the main channel of many of the river systems throughout the Coastal Plain. Accelerated sedimentation associated with erosion and channelization in alluvial systems has resulted in the formation of atypical geomorphic features (Happ et al. 1940). This type of sediment load resulting in large-scale landscape changes understandably has had tremendous ramifications to river systems.

Importance:

There are approximately 60,000 miles of streams and rivers that flow through Tennessee's diverse landscape. Six physiographic regions and five independent river drainages provide an incredible variety of habitats. Consequently, Tennessee's streams and rivers are recognized as having the richest freshwater biological diversity of any state in the U.S. They are home to some 330 species of fish, 120 species of mussels, 99 species of aquatic snails, 96 species of crayfish, and 70 species of amphibians. While Tennessee is home to many aquatic organisms, there are many species in jeopardy. TNSWAP lists 244 of these organisms as species of Greatest Conservation Need (GCN).

Tennessee's streams and smaller rivers are home to many sportfish species such as trout (brook, brown, and rainbow), catfish, black bass, crappie, sauger, white bass, striped bass, and sunfish. Until the 1930's, nearly all the public fisheries in Tennessee were in streams and rivers. In 2010, it was estimated that 397,515 anglers took a total of 3,214,303 trips to fish in Tennessee streams (Schexnayder and Fly, 2012). Tennessee's large rivers also provide important recreational and commercial resources. These rivers and their floodplain lakes currently have sport fisheries for catfish, black bass, crappie, sauger, white bass, striped bass, and sunfish. Commercial fisheries exist for catfish, paddlefish, buffalo, and other riverine fishes. Other public uses of rivers include water supply, aggregate dredging, waste dilution, navigation, and power generation.

Threats:

The biggest threat to productivity and biodiversity across the state is habitat loss or degradation due to past and ongoing activities throughout these watersheds. According to TDEC, the most common causes of pollution in rivers and streams are pathogens, habitat alteration, sedimentation, and nutrients. The sources for this are agriculture, hydrologic modification, and municipal dischargers. While best management practices can control sedimentation and excessive nutrients by reducing habitat alteration many streams are still negatively affected by sediment by continual and past land use practices. In addition, many dams and culverts also continue to limit movement of aquatic species and reduce water quality. Natural hydrologic functions have been altered by dam operations and water withdrawals. Besides limiting physical habitat in reduced channels, the lower flow rates also exacerbate water quality issues and fragment usable habitats.

The productivity and diversity of stream and river habitat is threatened by past and ongoing activities throughout the state. The most common water quality issue is sedimentation from past and current land use that creates excessive erosion. While best management practices can control sedimentation, many streams are still negatively affected by sediment. Many dams and culverts also continue to limit movement of aquatic species and reduce water quality. Natural hydrologic functions have been altered by dam operations and water withdrawals. Besides limiting physical habitat in reduced channels, the lower flow rates also exaggerate water quality issues. Climate change predictions suggest that Tennessee will experience a 2° C increase in temperature and an increased frequency of extreme weather events, such as intense rains and droughts. These conditions will further exacerbate the ongoing problems mentioned above.

In addition to the threat of habitat loss, stream and river species are also vulnerable to invasive species and over exploitation. Current regulations are designed to protect species, but these regulations must be continually evaluated to balance protection of species and recreational and commercial benefits.

Invasive species such as silver carp, Kentucky River crayfish, Didymo and many others continue to threaten native species through direct and indirect competition. Because invasive species are such a large threat to our sport and native aquatic wildlife, this plan dedicates a section to address them. See page 51, Extrinsic Factors on Wildlife Populations.

Objectives:

1. Manage and restore stocks of desired aquatic species.
2. Protect and restore the ecological integrity of streams and rivers.

OBJECTIVE 1. Manage and restore stocks of desired aquatic species.

Issue 1 Successful management of aquatic resources requires frequent monitoring, routinely updated operational plans, research, comprehensive data management, and regulations adjustments.

Strategy 1 Integrate surveys for non-game aquatics into existing programs

Strategy 2 Review data for priority watersheds and conduct inventories to fill gaps

Strategy 3 Consolidate and integrate databases housed within TWRA

Strategy 4 Evaluate and adapt data collection strategies to increase efficiency, improve data resolution, and reduce sampling bias

Strategy 5 Develop management plans for sport fisheries where needed and periodically update these plans

Opportunity 1 Populations of native aquatic species can be enhanced or restored to sustainable levels.

Strategy 1 Support or lead new development of enhancement and reintroduction projects

Strategy 2 Participate in U.S. Fish and Wildlife Service recovery planning processes

Strategy 3 Identify and engage key partners to assist with conservation projects

Strategy 4 Expand propagation facilities for species of Greatest Conservation Need

Strategy 5 Expand or renovate propagation facilities for sport fish species

Issue 2 Some species do not have adequate legal protection.

Strategy 1 Review state listings twice during this plan cycle

Strategy 2 Conduct a review of existing regulations related to non-game species and implement necessary changes as needed

OBJECTIVE 2. Protect and restore the ecological integrity of rivers and streams.

Issue 1 Incompatible land use and other human activities have impaired many streams and rivers.

- Strategy 1 Identify and prioritize watersheds in need of conservation or restoration, particularly on TWRA lands and headwaters which may greatly affect downstream reaches
- Strategy 2 Support non-Agency conservation/restoration efforts for priority streams and rivers
- Strategy 3 Support non-Agency efforts to reduce point and nonpoint source pollutants for priority streams and rivers by providing review and comment during the regulatory process
- Strategy 4 Identify and engage key partners to assist with stream and river conservation projects
- Strategy 5 Ensure that all management activities on TWRA lands follow BMP's for watershed protection
- Strategy 6 Ensure that abandoned coal mine reclamation projects restore streams and rivers degraded by past mining activities
- Issue 2 Connectivity is limited by channel structures such as culverts and dams.
- Strategy 1 Address connectivity issues associated with dams and road systems. Participate in at least one dam removal project
- Issue 3 Altered flows from dam operations and water withdrawals reduce habitat for riverine species.
- Strategy 1 Establish instream flow requirements for priority aquatic systems

IMPOUNDMENTS

Definition:

Impoundments are man-made lakes and ponds that were formerly free-flowing streams and rivers but are now blocked by a dam. Water trapped behind the dam often lacks flow and develops ecological functions and fish communities like those of a natural lake. Many larger reservoirs (>600 acres), especially those impounded on major rivers, display a continuum of conditions and fish species from the upstream (riverine) reaches to the dam, where they more closely resemble lake habitat. Because most reservoirs are built for purposes like flood control, hydropower production, and water storage, aquatic species are subject to dynamic habitat conditions such as changing flows, water level fluctuation, and water quality changes. Smaller impoundments (ponds and small lakes <600 acres) are usually not subject to rapidly changing habitat conditions and tend to have more stable fisheries.

RESERVOIRS AT A GLANCE

Habitat Categories	Reservoirs Small Impoundments (less than 500 acres) Ponds (typically less than 5 acres and private)
Species	Hundreds of species of fish, mussels, and turtles Priority sport fish: black bass, crappie, catfish, sauger, walleye, white bass, striped bass, and trout Priority commercial fish: catfish, paddlefish, and buffalo
Threats	Water level fluctuations Habitat loss Incompatible use Invasive exotic species Erosion and Sedimentation
Strategic Objectives	Maintain and restore stocks of desired fish, mussel and turtle species. Maintain or enhance reservoir and lake fish habitats.

Impoundments in Tennessee:

Reservoirs provide a variety and abundance of fishing opportunities across Tennessee. The Agency manages fisheries in 32 man-made impoundments, representing 500,618 surface acres and one natural lake (Reelfoot Lake), representing 10,427 acres (Table 1-4). The reservoirs range in size from 541 acres to 108,217 acres within state boundaries and include an additional 202,380 acres outside the state (Figure 1-3). There are an estimated 99,250 additional acres of ponds in Tennessee (Tom Cross - UT Extension Service, personal communication).

Large Tennessee reservoirs consist of mainstream impoundments, tributary impoundments, and Reelfoot Lake, formed by an earthquake in the early 19th century. Most reservoirs are located within the Cumberland or Tennessee River drainages. Reelfoot Lake is in the Mississippi River drainage. Large reservoir and lake resources range from shallow, highly productive Reelfoot Lake in northwestern Tennessee to deep, clear, and much less productive Watauga Reservoir in the northeastern corner of the state. Tennessee's small impoundments are usually fairly to highly productive, while spring-fed lakes tend to be moderately productive.

Fish communities within Tennessee impoundments vary greatly in quality and abundance. Watershed characteristics influence the character of ponds and reservoirs. Sport and commercial fishing opportunities are limited by available habitat, predator-prey balance, potential for overexploitation of

fish stocks, and productivity of each system. The biological potential of individual impoundments; fishing opportunities desired by the public; and potential for unintended harvest are the primary factors driving which species will be managed in a particular fish community.

History:

Tennessee River reservoirs were impounded by the TVA from the late 1930s through the 1970s. Cumberland River Reservoirs were constructed by the USACE during the 1940s through the 1960s. All reservoirs in Tennessee provide public fishing and access. Boat and bank access areas are provided by several federal and state agencies, including TVA, USACE, TDEC and TWRA, as well as city and county governments. Reservoirs provide self-sustaining sport fisheries that include black bass (largemouth, smallmouth, and spotted), crappie (white and black), catfish (blue, channel, and flathead), sunfish (primarily bluegill and redear), sauger, walleye, and white bass. Stocked sport fisheries include trout (rainbow, brown, and lake), muskellunge, striped bass, and Cherokee bass (hybrid striped bass). Supplemental stockings of black crappie, Florida strain largemouth bass, walleye, and sauger have been used to enhance fisheries or provide unique fishing experiences in some reservoirs. In contrast, ponds and small lakes may allow free fishing or pay fishing but are usually privately owned and managed. Commercial fishing for paddlefish, catfish, carp, and buffalo occurs at several riverine impoundments of the Cumberland and Tennessee rivers. Most commercial fishing occurs on the lower Tennessee River (Kentucky Lake), lower Cumberland River (Barkley Lake) and the Mississippi River.

During recent decades, considerable effort has been aimed at providing optimal sport fishing through implementation of harvest restrictions. TWRA fishery biologists have been diligent in making daily creel limits and size limits as uniform as possible. Length limits have been tailored for high-harvest fisheries such as crappie and walleye, and to provide a higher level of protection for fisheries that are largely catch-and-release such as largemouth bass and smallmouth bass. Poudyal, Silwal and Watkins (2020) found that angler satisfaction with TWRA's reservoir fisheries management has remained high with 76% of anglers indicating they were somewhat satisfied or very satisfied with their most recent fishing experiences in Tennessee. Private ponds and small lakes have not been a significant TWRA management focus in recent years unless public access is allowed.

Importance:

During a recent survey by Poudyal, Silwal and Watkins (2020), Tennessee anglers were asked to indicate all the area types where they had spent time fishing. Anglers responded that they had fished in large impoundments (69%), small lakes (50%), state park lakes (35%), agency lakes (19%) and private ponds and lakes (17%). The most recent statewide creel survey, Black (2020), indicated that black bass continued to be the most sought species group accounting for 30.2 % of the angler effort followed by black and white crappie (17.8%). There are a vast number of fishing lakes throughout the state of Tennessee many of which were created and managed by the Agency (Figure 1-4). Although similar values for ponds and small lakes were not attainable, the values cited above indicate that fishing at impoundments provides significant recreation and local economic input.

Threats:

Variations in annual rainfall can influence habitat factors such as water quality, flows, water levels, and aquatic vegetation which, in turn, have influenced spawning success and recruitment of several fish species. Some fish populations such as crappie and sauger have cyclical recruitment due to environmental and density dependent factors. Productivity measured in standing crop (pounds per acre) or density (catch per unit effort) varies across the state, within each reservoir, and from year to year. Nutrient inflow from watersheds is the primary determinant of reservoir productivity. Habitat degradation, water pollution, and water level fluctuations also adversely affect reservoir fish populations and must be addressed by this plan.

Habitat enhancement and fish attractor projects that strive to enhance fish survival and recruitment as well as bring anglers and fish together will become increasingly important components of TWRA's reservoir management program. Demands for stocked fish from TWRA hatcheries can be expected to increase as natural stock recruitment decreases from habitat loss, sedimentation and interactions with invasive species increases (for more on invasive species, see page 51, Extrinsic Factors on Wildlife Populations).

Objectives:

1. Maintain, restore, and enhance stocks of desired fish, mussel, and turtle species.
2. Maintain or enhance reservoir and lake fish habitats.
3. Monitor invasive organisms and develop methods to control their impacts on native species.

OBJECTIVE 1. Maintain and restore stocks of desired fish, mussel, and turtle species.

Issue 1 Fish, mussel, and turtle populations are dynamic, requiring adaptive management, frequent monitoring, and detailed research.

Strategy 1 Use established techniques to evaluate population size, structure, growth, mortality and density for sport and commercial fisheries for a minimum of 20 impoundments per year and report results and recommend management strategies annually

Strategy 2 Evaluate existing fisheries, identify management needs, and as needed develop new assessment and monitoring programs

Strategy 3 Routinely evaluate existing harvest regulations for fish, mussels, and turtles

- Strategy 4 Enhance and restore sport fish through stocking and harvest restrictions as needed, using biologically and sociologically feasible means
- Strategy 5 Enhance and manage existing fish hatchery facilities to increase annual production to meet current and future program needs
- Strategy 6 Evaluate stocking success and refine stocking numbers and locations as needed
- Strategy 7 Develop two research projects to answer complex management questions
- Strategy 8 Continue to provide technical assistance for private ponds using print and web-based informational materials. Conduct on-site surveys as feasible when proper assistance cannot be provided via phone, text, email, or other outlets
- Strategy 9 Conduct at least one research project on commercially harvested turtle populations

OBJECTIVE 2. Maintain or enhance reservoir and lake fish habitats.

- Issue 1 Dam operations directly affect fish habitat. Flood control demands rapid fluctuations of reservoir elevations resulting in loss of critical habitat for reservoir species during critical stages. Dam releases can have both negative and positive effects on water quality.
- Strategy 1 Continue to provide reservoir operations recommendations to TVA and the U.S. Army Corps of Engineers (USACE) for at least 20 reservoirs during the plan period
- Strategy 2 Participate in outreach to educate the public about TVA and USACE water level management
- Issue 2 Inshore and offshore physical habitat is relatively scarce on large reservoirs. Over the decades, much of the submerged vegetation (smaller diameter) has decayed and shoreline aquatic plants cannot be established due to water level fluctuations.
- Strategy 1 Maintain or expand habitat enhancement and fish attractor programs including small woody debris, stake beds, rock, and artificial structures in 10 or more impoundments per year
- Strategy 2 Monitor or improve beneficial aquatic vegetation in impoundments where feasible

Strategy 3 Work with agencies and NGO partners when feasible to improve aquatic habitat in at least 10 large and small impoundments

Strategy 4 Provide reservoir fish habitat maps or coordinates on TWRA website or mobile application

Strategy 5 Stabilize eroding reservoir and tributary stream banks following BMP guidelines

Issue 3 Productivity of Tennessee's reservoirs changes as a function of time and watershed condition. Such changes affect trophic states and critical habitat, and ultimately management options.

Strategy 1 Collect and review physical and water quality conditions at a minimum of 20 reservoirs and lakes per year (using data from TVA or USACE if available) and develop appropriate management recommendations if necessary

OBJECTIVE 3. Monitor invasive organisms and develop methods to control their impacts on native species.

Issue 1. Asian carp have invaded the Tennessee and Cumberland river systems and have the potential to alter habitat and displace native aquatic organisms.

Strategy 1 Use established techniques to evaluate leading edge expansion, population size, structure, growth, mortality, recruitment, and density for Asian carp fisheries and report results and recommend management strategies annually

Strategy 2 Support, utilize, and monitor mass removal efforts (including commercial fishing) to reduce Asian carp density and propagule pressure

Strategy 3 Work with state and federal partners to support research and implementation of barrier technology to limit or mitigate migration of Asian carp into and through Tennessee waterways

Strategy 4 Increase public awareness through frequent engagement via social media, outreach events, informational press releases, and web updates

Strategy 5 Annually review bait regulations to prevent the further spread of Asian carp as bait

Table 1-4. Surface acres of Tennessee Reservoirs greater than 500 acres. Reelfoot Lake is included.

Acreage in Tennessee		Total Acres		Data Source*
Barkley	10,350	57,420		4
Boone	4,520			1
Calderwood	541			1
Center Hill	18,220			2
Cheatham	7,450			2
Cherokee	30,300			1
Chickamauga	34,500			1
Chilhowee	1,750			1
Cordell Hull	11,960			2
Dale Hollow	23,200	27,700		3
Douglas	30,600			1
Ft. Loudoun	14,600			1
Ft. Patrick Henry	872			1
Great Falls	3,080			1
Guntersville	1,156	67,900		4
John Sevier	786			4
J. Percy Priest	14,200			2
Kentucky	108,217	160,300		4
Melton Hill	5,690			1
Nickajack	10,370			1
Normandy	3,048			4
Norris	34,200			1
Old Hickory	22,500			2
Parksville	1,890			1
Pickwick	6,159	43,100		4
Reelfoot L.	10,427			4
South Holston	6,336	7,580		4
Tellico	16,056			4
Tims Ford	10,600			1
Watauga	6,430			1
Watts Bar	39,000			1
Woods	3,660			4
<i>Total</i>	<i>492,668</i>			

¹TVA 1980

²U.S. Army Corps of Engineers 1978

³-----, H. Phillips, personal communication 1993

⁴TWRA 2006

Figure 1-3 Distribution of major reservoirs (including Reelfoot Lake) in Tennessee

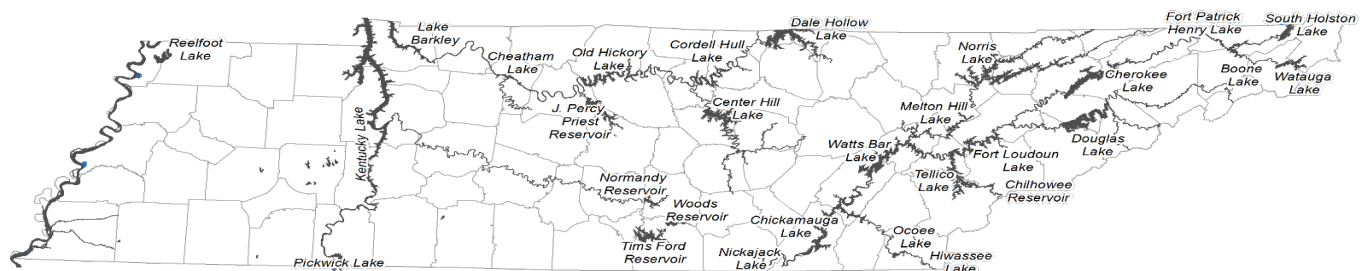
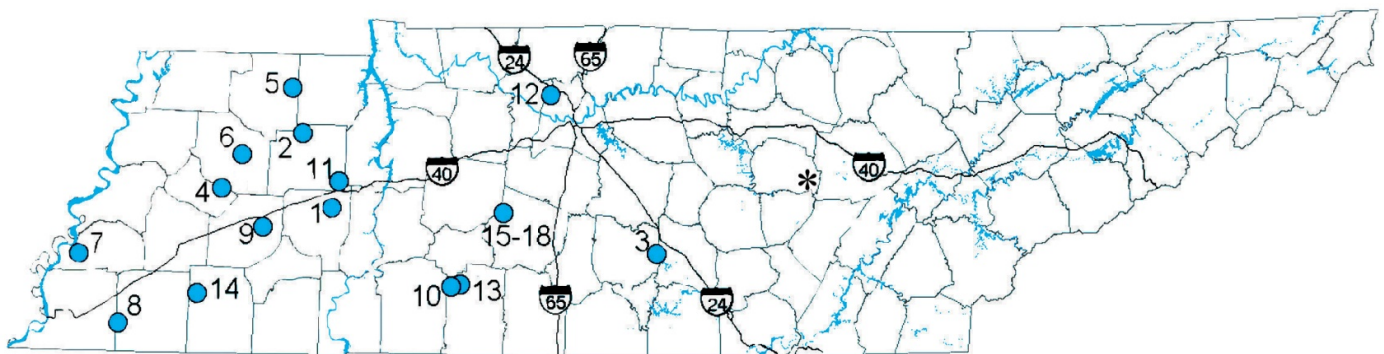


Figure 1-4. Distribution of TWRA Fishing Lakes (excludes lakes managed by TDEC).



- ¹Brown's Creek Lake (Henderson County) 167 acres;
- ²Carroll Lake (Carroll County) 100 acres;
- ³Coy Gaither/Bedford Lake (Bedford County) 47 acres;
- ⁴Davy Crockett Lake (Crockett County) 87 acres;
- ⁵Garrett Lake (Weakley County) 183 acres;
- ⁶Gibson County Lake (Gibson County) 560 acres;
- ⁷Glenn Springs Lake (Tipton County) 310 acres;
- ⁸Herb Parsons Lake (Fayette County) 177 acres;
- ⁹Lake Graham (Madison County) 500 acres;
- ¹⁰Laurel Hill Lake (Lawrence County) 325 acres;
- ¹¹Maples Creek Lake (Carroll County) 90 acres;
- ¹²Marrowbone Lake (Davidson County) 60 acres;
- ¹³VFW Lake (Lawrence County) 22 acres;
- ¹⁴Whiteville Lake (Hardeman County) 158 acres;
- ¹⁵⁻¹⁸Williamsport Lakes (Maury County) - Whippoorwill - 25 acres; Blue Cat - 80 acres; Goldeneye - 13 acres; and Shellcracker - 46 acres;
- *Bridgestone/Firestone WMA Youth Fishing Ponds (White County) 15 acres

URBAN

Habitat Groups – Urban Forest, Urban Grassland, Manmade Structures, Impervious Landscape

Definition:

Urban habitats and the animals which reside within them elicit many thoughts among people, both positive and negative. Urban areas provide altered but unique ecological systems that present a variety of opportunities for a wildlife management agency. Therefore, given their impacts on native plant and animal communities, the inclusion of urban areas is an important part of the Agency's strategic planning process. The Tennessee State Wildlife Action Plan (TNSWAP) identifies urban habitat groups and associated habitat alliances (see above) but does not provide a definition of these mapped habitats presumably because of the poor affiliation of species of greatest conservation need (GCN) and these habitat types.

The definition of urban habitats is complex and, within the context of a strategic plan, inextricably linked to the process of urbanization. Adams and Lindsey (2010) provide a good discussion of urban habitats:

Americans may like to think of themselves as a primarily rural nation, but nearly 80 percent of those who dwell in the 48 lower states live in areas classified by the U.S. Census Bureau as urban: "a large central place and adjacent densely settled census blocks that together have a total population of at least 50,000." Also known as the "built environment," the urban wildlife management landscape includes places where most of the land is devoted to all things man-made and/or maintained: buildings of all shapes and sizes, manicured lawns and landscaped office parks, cemeteries and vacant lots, strip malls and high schools and warehouse districts. A substantial portion of this land is covered with impervious surfaces, in the form of both structures and pavement. The plant life is mostly native to other parts of the world or highly hybridized, and thus in need of a lot of caretaking, in the form of sprinkler systems, herbicides, pesticides, and fertilizers. Urban in this context includes both the cities and the suburbs.

The Adams and Lindsey (2010) definition is robust to most urban areas but they did not include parks or similar areas in their definition. For the purposes of this document, parks and other open greenspaces embedded within the urban/suburban landscape are considered under the definition of urban habitats.

Urban habitats can be quantified to provide a static estimate of what is currently present, but an equally important factor is the process of urbanization. If urban habitats were static, they might be managed to maximize opportunities and minimize impacts, but human populations continue to grow and associated impacts to the landscape must be considered. Urbanization can be defined from a human population perspective as rural persons moving to urban areas with subsequent shifts in the demographics from rural to urban. A more complete consideration of urbanization from a habitat perspective would include the impact of this shift in demographics on the local landscapes. In this vein, the Tennessee Department of Agriculture (2010) defines urbanization from a forestry perspective, as:

Urbanization refers to the spread of urban land uses (residential, commercial, or industrial) into forested areas. The fringes of expanding urban areas, where forest and agricultural uses are interacting with increasing urban development, identify the wildland urban interface (WUI). The WUI is a zone of dynamic land use change activity that brings on complex challenges for residents, natural resource professionals and local governments.

The forestry-based definition can easily be expanded to any native habitat and introduces the concept of the WUI. The WUI is ambiguously defined but is best left vague as the dynamic nature does not allow a precise definition. The WUI is where most land-use conversion will take place and sets the stage for the necessary discussion of urbanization and associated management complexities. Tennessee is expected to have a 90% increase in converted lands before 2030 with a projected 2.4 million acres of rural land being developed (White et al. 2005) which emphasizes the importance of discussing urban habitats and urbanization.

History:

The southeastern US is undergoing consistent, rapid urban growth, with North Carolina, Georgia and Florida leading the way and Tennessee experiencing similar trends (White et al. 2009). Recent estimates indicate areas impacted by urban growth in Tennessee increased by 58% between 1982 and 1997 with 865,000 acres of land developed (White et al. 2009). Nowak et al. (2005) estimated that 4.4% of Tennessee was urbanized in 1990 and increased to 5.8% by 2000 with the urban expansion taking approximately 358,000 acres during the decade and making Tennessee the 19th most urban state in the US. Future urban expansion is estimated to have Tennessee as the 15th most urbanized state by 2050, with approximately 15.3% of the state considered urban (Nowak and Walton 2005).

The TWRA has little to no history with active management of urban habitats and traditionally focuses its efforts on rural landscapes. This strategic plan is the first known attempt to formally consider urban habitats and their associated positive and negative impacts on the wildlife habitats and human populations in Tennessee. While urban issues are not new to the TWRA, the Agency has typically taken a passive stance regarding urban habitats and urbanization. The TWRA's future direction should seek to actively engage management within existing urban habitats while considering the impacts of future urbanization on the state's natural resources.

Importance:

Urban habitats do not fit easily into a single discussion of importance like other habitat chapters because there are positive and negative implications of urban areas. Existing urban areas provide wildlife habitats, albeit not what are considered traditional habitats. Public lands within the urban matrix offer opportunities for outdoor recreation and education. Such programs to engage the urban public in these areas for education and hunting/fishing opportunities are more thoroughly addressed in the Outdoor Recreation and Information & Education chapters, respectively.

The importance of urban habitats differs from that of other habitats discussed in this plan in that the urbanization process permanently eliminates native/natural habitats directly and indirectly. Conversion of acres from rural uses to residential, commercial, or industrial uses in many traditional development scenarios destroys all-natural function of the converted habitat and leaves no large-scale habitat. Cultural paradigm shifts are trending toward green growth initiatives that have ecological considerations built into the growth plans. Working within existing initiatives or helping to develop new initiatives is an untapped management mechanism for the TWRA. The Agency has assisted in several efforts but to date no personnel are designated specifically to these tasks. While this plan does not recommend adding staff to perform such tasks, the long-term benefits of engaging in such new endeavors may be a worthy effort to help minimize the impact of urbanization.

Threats:

Urban habitats are not threatened in the usual sense, but they (and the urbanization process) do constitute a threat to other habitats. Existing urbanized areas are very unlikely to be converted back to part of a larger functioning ecosystem and future urbanization will continue to usurp native habitats. Such habitat loss, along with indirect impacts of pollution and other factors can degrade nearby natural habitats as well and ultimately affect large portions of the Tennessee landscape.

The TNSWAP developed prioritized sources of stress for each of the six terrestrial regions in Tennessee. Primary residential development and commercial/industrial development were listed among the top three stresses associated with all six terrestrial habitat types. Urban stresses to aquatic systems were also identified in TNSWAP but the types of stress were not as clear for each river system. Dams and impoundments, residential development, and residential sewage/septic systems were all important, but their importance varied dramatically among watersheds. However, urban-related issues (particularly sewer septic systems) were among the top three stressors in all physiographic regions. Such high prioritization of urban stresses in terrestrial, aquatic, and subterranean habitats indicates that management/policy action directed at reducing the impacts of urbanization should have positive impacts on all terrestrial GCN species.

Objective:

1. Maximize management opportunities within the urban landscape to enhance productive wildlife habitat.

Objective 1 Maximize management opportunities within the urban landscape to enhance productive wildlife habitat.

Opportunity 1 Initiatives that focus on urban planning and green growth often seek diverse partners to integrate urban growth with natural resource conservation.

Strategy 1 Increase participation in or formation of strategic alliances that promote the improvement of land-use planning and zoning practices affecting urban wildlife species and their habitats

Strategy 2 Increase urban wildlife management opportunities on private lands by providing technical assistance and encouraging the use of incentive programs

Strategy 3 Support outreach efforts promoting conservation or management of urban wildlife and their habitats

EXTRINSIC FACTORS ON WILDLIFE POPULATIONS

Habitat Groups: Implications to all habitats

This chapter captures several factors that are ubiquitous to all habitats and wildlife populations in Tennessee and therefore require discussion separate from each habitat group. The primary foci are human/wildlife conflicts, problem populations (overabundant, invasive, extirpated native etc.), diseases, and climate change. These are, on the surface, disparate issues but drawn together they represent important external stresses impacting the wildlife populations and habitats of Tennessee. In most cases these extrinsic factors are independent of wildlife populations. Examples of this are urbanization changing the landscape with unintended consequences resulting in an increased need for animal damage control, new or expanding diseases (chronic wasting, white-nose syndrome etc.) emerging from within the state, or the global impacts of climate change played out on a local scale in Tennessee.

Definition:

Nuisance or overabundant flora and fauna – Nuisance animals are often immediately and sometimes erroneously categorized as overabundant. Whether an individual animal problem or a true population problem, management actions should address these as separate issues. State laws are written such that landowners determine if an animal is a nuisance and these animals are often single individuals rather than members of a burgeoning population. Traditional management of nuisance animals, as defined by the landowner, is handled through big game depredation permits or the animal damage control (ADC) permit process.

Nuisance wildlife calls from the public appear to be increasing and handling them is an ever-present duty for the TWRA throughout the State. While traditionally concentrated in urbanized areas the nuisance complaints are expanding beyond raccoons in attics to include rural problems with otters, beavers, deer, bear, coyotes, and other species. Additionally, species that are naturally expanding their ranges (e.g., armadillo) are resulting in nuisance problems in both urban and rural areas.

Overabundant wildlife populations are an increasing concern for the Agency and overabundance is often defined by social carrying capacity. Schexnayder et al. (2012) estimated one in four Tennesseans (26%) experience property damage from nuisance wildlife. Social Carrying capacity is a moving target that is not well-suited to traditional wildlife management methods or objectives. Species restored by the TWRA (e.g., deer, turkey, otter) are reaching overabundant levels in many parts of the state. Other species entering the state (e.g., coyote and armadillo) are similarly at population levels beyond social carrying capacity. The Agency needs to consider the implications of allowing populations to grow beyond social carrying capacity or other species (e.g., bear and elk) may follow a similar path to overabundance. The efficacy of programs designed to address species that exceed social carrying capacity should be evaluated and ultimately redesigned to ensure maximum relief and benefit to landowners with nuisance animals, while encouraging co-existence.

Invasive flora or fauna – Invasive species are an increasing problem that spans a variety of species from multi-flora rose to *Hydrilla* to Asian carp to wild hogs and covers all major biotic classes. Invasive species are not new to Tennessee, but their impacts may become more significant.

Transforming the management status of wild hogs from a big game species to a species deemed destructive is a leading example of a population growing beyond the desired levels (albeit with illegal transportation aiding the spread). The economic and environmental damage potential of this population is extraordinarily large if the TWRA does not continue aggressive management actions.

The ultimate importance of invasive species on the native flora and fauna cannot be accurately estimated because the populations are constantly in flux, as is our understanding of their impacts to native ecosystems. The costs associated with these invasive species are socio-economic as well as ecological. For example, Asian carp in our nation's waterways may impact native fish stocks on which sport-fishing communities rely into the billions of dollars. Nationally, wild hogs cause damages to agricultural production that reach easily into the hundreds of millions of dollars annually. The impacts in Tennessee, though unknown at this time, may be staggering; however, given the early stages of Asian carp populations and wild hog range expansion, negative impacts may be reduced with proper management actions.

The Agency dedicates a great deal of resources to invasive species, but consistent management direction is often lacking. The Tennessee Aquatic Nuisance Species Management Plan provides guidance for managing invasive species in aquatic settings, but no such plan exists for terrestrial organisms. A plan to manage terrestrial invasive populations needs to be developed to provide a cohesive management message and direction for all major invasive species.

Diseases of flora and fauna – Endemic diseases are a normal component of natural systems and typically do not have large impacts on native populations. These diseases are often noticed by the public (e.g., Epizootic Hemorrhagic Disease outbreak in deer) but are most often inconsequential to native populations or their management. In contrast, introduced diseases may have dramatically different impacts and have the potential to completely alter natural systems (e.g., chestnut blight). Historically, new diseases were introduced infrequently so they had little impact to these systems (with the chestnut blight exception) but with a more globalized society there appears to be new disease threats appearing regularly. Chronic wasting, white-nose syndrome, whirling disease, avian influenza, and numerous other diseases are becoming increasingly common.

Emerging diseases that are novel to the native flora and fauna on Tennessee are the largest threats. Chronic Wasting Disease (CWD), detected in Tennessee in 2018, is an always-fatal disease of cervids (deer and elk) and may cause significant declines in native cervid populations. It is possible that the numbers of hunters pursuing those animals may also decrease. Game animals are not the only fauna at risk. White-nose syndrome in bats may fundamentally change the structure of the bat population assemblage in Tennessee and ultimately alter how we manage bats and their habitat on public lands. Similar impacts can be seen with forest management strategies that now must consider emerald ash

borer, 1000 cankers of walnut, or hemlock woolly adelgid and their attempts to restrict the expansion of these diseases/pests.

Whirling disease has the potential to significantly impact native and wild trout populations as well as numerous Agency programs that utilize stocked trout. Impacts to hatchery operations and reduced production would likely strain current stocking regimes, meaning fewer opportunities for Tennessee anglers. Game animals are not the only fauna at risk. White-nose syndrome in bats may fundamentally change the structure of the bat population assemblage in Tennessee and ultimately alter how we manage bats and their habitat on public lands. Similar impacts can be seen with forest management strategies that now must consider emerald ash borer, 1000 cankers of walnut, or hemlock woolly adelgid and their attempts to restrict the expansion of these diseases/pests.

Climate change – The TWRA’s first formal treatment of climate change was published in 2009 (TWRA 2009) and addressed the impacts of climate change on Tennessee’s native wildlife populations and habitats. As an update to the TNSWAP, this document provides a solid background for the potential problems that may arise if climate change persists and was based on the best available knowledge of the time. This effort and the Agency’s involvement in joint ventures (JV) and other landscape conservation cooperatives shows commitment to the issue and concern for the impacts but the Agency does not currently have personnel devoted to developing a formal program to implement climate related strategies.

The discussion of climate change within the context of a six-year strategic plan is an important step, but what can realistically occur in this limited time span must also be considered. Many national and international organizations are in the planning processes for what should be done with groups like the Intergovernmental Panel on Climate Change (IPCC, United Nations), established in the last 10 years. The threat of accelerating climate change on native populations can be minimized by replicated habitat protection for rare species, creating north-south travel corridors and many other management strategies. However, for an agency with few resources directly assigned to climate change policy, expectations for dealing with climate change need to be realistic, especially in the timeframe allowed for this plan. The Agency recognized the importance of accelerating climate change in their 2009 report (TWRA 2009). Our steps toward implementing climate change policies within our management strategies and land acquisition strategies may be better addressed in the Agency’s core beliefs and mission rather than assuming we can meet the objectives laid out by national and international planners. Continued engagement with JVs and other landscape cooperatives, as well as efforts to remain current on management and planning will be critical. Changing information about accelerating climate change and its potential impacts to native flora and fauna should be the basis of how the Agency plans large-scale management initiatives and land acquisitions.

Objectives:

1. Minimize flora and fauna having negative impacts on native species, habitats, water quality and socioeconomics.
2. Restore extirpated native terrestrial and aquatic species where feasible.
3. Minimize impacts of diseases on desired flora and fauna.
4. Stay current and proactive in addressing resource issues that are impacted by climate change.
5. Agency personnel seek opportunities to learn new information about the effects of climate change and how it impacts wildlife and their associated habitats.

OBJECTIVE 1 Minimize negative impacts of non-native flora and fauna on native species, habitats, water quality and socioeconomics

Issue 1 Exotic, invasive, nuisance or other species deemed destructive or over-abundant are an increasing threat to desired populations and habitats.

Strategy 1 Implement Tennessee Aquatic Nuisance Species (ANS) management plan

Strategy 2 Develop and implement Tennessee nuisance species plans for terrestrial wildlife and plants

Strategy 3 Support existing and develop new programs to help control invasive species through non-traditional methods (e.g. commercial value)

Strategy 4 Work with other management agencies and NGOs to evaluate and install barrier deterrent system at strategic locations

Strategy 5 Develop an in-house program that would direct and implement control strategies for invasive species

Strategy 6 Continue to seek funding sources to support existing and new control programs

Strategy 7 Enact and/or support development of regulations that restrict the potential to introduce/spread invasive within Tennessee

Strategy 8 Continue to document presence and spread of invasive species

Issue 2 Negative interactions between humans and wildlife continue to increase.

Strategy 1 Maximize hunting, fishing, and trapping to manage problem wildlife populations

Strategy 2 Create and utilize innovative programs that educate the public on problem wildlife and their habitat (e.g., coexisting with wildlife and/or providing tools/information to alleviate human/wildlife conflicts)

Strategy 3 Increase effectiveness of the ADC program by expanding services and information provided by the Agency and approved permittees

Strategy 4 Increase partnerships that address solutions to common human/ wildlife conflicts

Strategy 5 Utilize hunting, fishing, and trapping opportunities to address excess social carrying capacity issues when appropriate

OBJECTIVE 2 Restore extirpated native terrestrial and aquatic species where feasible

Issue 1 Some native wildlife populations have become extirpated from their historic ranges.

Strategy 1 Evaluate the feasibility of restoring native terrestrial and aquatic species on lands where natural populations have been extirpated and restore populations if possible

Strategy 2 Monitor native species in decline and determine if management strategies can be implemented to reverse or prevent further decline

OBJECTIVE 3 Minimize impacts of diseases on desired flora and fauna

Issue 1 Emerging and recurring diseases pose threats to existing populations.

Strategy 1 Review and update if necessary, Hazard Analysis Critical Control Points (HACCP) plans for fish hatcheries once during the cycle

Strategy 2 Enact and/or support development of regulations that restrict the potential to introduce emerging diseases to Tennessee

Strategy 3 Enact and/or support development of regulations that restrict the potential to spread diseases within Tennessee

Strategy 4 Create a Task Force to identify training needs, information gaps, monitoring protocols or other concerns for diseases

Strategy 5 Proactively monitor and prioritize high risk areas/populations and respond to diseases as appropriate through eradication and/or control

OBJECTIVE 4. Adaptively manage Tennessee's wildlife resources to address a changing climate

Issue 1 Uncertainty of future climatic conditions makes it difficult to develop long term wildlife management strategies.

Strategy 1 Review and update the potential impacts of Climate Change to Wildlife in Tennessee and incorporate into the TNSWAP

Strategy 2 Participate in regional initiatives such as Joint Ventures and Southeast Conservation Adaptation Strategy

Strategy 3 Increase adaptive management practices that make wildlife habitat and populations more resilient to climate change

Strategy 4 Monitor such diseases as White-nosed Syndrome, Snake Fungal Disease, Ranavirus and Chytrid fungi including Batrachochytrium salamandrivorans (Bsal) throughout the state

Goal:

To increase and maintain opportunities for hunting, fishing, and boating and accommodate other outdoor recreation that is safe for users and the environment yet consistent with conservation principles.

Definition:

Outdoor recreation is broadly defined as any leisure activity that takes place outside. TWRA actively promotes fishing, hunting, trapping, wildlife viewing, and boating. While these activities remain the Agency's primary focus, this plan will address other activities that are, or could be, welcomed on TWRA lands. These include but are not limited to camping, hiking, caving, horseback riding, off-highway vehicles, bicycle riding, rock climbing and geo-caching. Wildlife Management Area managers have identified at least 20 varieties of outdoor recreation occurring on TWRA lands (Table 1-5). This plan will focus on outdoor recreation associated with publicly held wildlife and waterways, and at TWRA-managed lands. Recreation on TWRA lands will be limited to those activities that will not harm the resource or impair the enjoyment of license-holding users. This is oftentimes difficult since TWRA lands must continue to serve the purpose for which they were acquired, and hunting and fishing license funds cannot be used for non-wildlife activities.

Outdoor Recreation in Tennessee:

Tennessee's natural resources provide numerous and diverse opportunities for outdoor recreation. In 2011, five million people participated in outdoor activities such as fishing, hunting and wildlife viewing in Tennessee (USFWS 2012). Approximately 246,000 people have motorboats for Tennessee's waterways. Millions more are hiking, paddling, and just getting outside. TWRA's mission statement recognizes this value of recreation and motivates staff to manage resources for the enjoyment of citizens and visitors.

Recreation is an objective of many land-managing municipalities and agencies such as Tennessee Department of Environment and Conservation (TDEC), United States Forest Service (USFS), Tennessee Valley Authority (TVA), National Park Service (NPS), and United States Army Corps of Engineers (USACE). TWRA partners with several agencies, municipalities, and non-government organizations (NGOs) to provide land and wildlife for outdoor recreation. Many entities provide outdoor recreation without TWRA involvement. TWRA is unique in that it not only offers recreation on the over 1 million acres of land that we manage, but it also manages and promotes recreation associated with the publicly owned populations of wildlife wherever they occur. Likewise, TWRA provides access to public waterways while it owns relatively little aquatic habitat.

TWRA promotes recreational opportunity through a variety of its core functions. Through the decades TWRA has acquired large tracts of land for wildlife habitat. Nearly all these areas are open to the public, except during big game hunts. TWRA also owns smaller parcels located along public waterways which provide parking, ramps, and other amenities for a variety of water users. TWRA manages populations of

game species for recreation through habitat enhancement, by setting hunting and fishing regulations, and by stocking desirable fish species for anglers, and by providing an established and focused law enforcement presence. The primary role of TWRA's management is to maintain populations of species, but they also enhance recreational aspects of hunting or fishing. TWRA promotes safe recreation on land and water through educational programs and enforcement of regulations. TWRA also recruits new outdoors enthusiasts through educational programs and specialized events. We also provide support for other entities encouraging outdoor participation through educational programs and events.

Primarily it has been hunters, anglers, and registered-boat owners that have funded the acquisition and management of TWRA lands and access to waterways, but this paradigm may not be sustainable. TWRA relies on revenue from hunting and fishing licenses, boat registration, federally collected taxes on hunting, fishing and boating gear, real estate taxes (for wetlands) and donations to its license plate funds to maintain its programs. These funding sources have been reliable, but they are not growing in proportion to Tennessee's population. With time more people are discovering the outdoor opportunities at TWRA lands, but many of them pursue activities that do not require any license or contribution to TWRA. For example, people regularly use TWRA ramps to go kayaking (a growing sport) or visit a WMA to ride their horse or an ATV. Both activities generate costs, as the Agency provides law enforcement, litter pickup, and maintains roads. In addition, some of these activities can conflict with hunting or fishing opportunities that arguably should have a priority due to the funding history. TWRA is trying to accommodate non-paying users as much as possible, but it adds to the cost of management.

With proper funding and planning, many WMAs could support much more outdoor recreation. While WMAs are well known to traditional users, these areas are generally unknown to many other recreational groups. The WMA managers focus on wildlife populations, their habitats, and the hunting seasons. TWRA does not actively promote additional activities at most of its WMAs. Some are designed to host multi-use management (e.g. North Cumberland with hunting, wildlife viewing and OHV), but many have yet to plan and promote for more types of recreation. Despite the lack of advertising, WMA managers already have numerous multi-user conflicts. While the WMAs do have much more to offer the public, the Agency needs public support in finding more reliable streams of revenue for our wildlife resources. Such public support would also be useful in acquiring more habitats for wildlife and users.

Importance:

Outdoor recreation provides benefits to individuals, society, and wildlife. People participate to have fun, and there also health benefits associated with both activity and relaxation. Fishing and hunting provide meat that is a valued supplement to store-bought foods. Outdoor recreation delivers revenue and jobs to regions that support daytrips and vacationers. Nationally, recreation generates \$887 billion in sales supporting 7.6 million jobs (Outdoor Industry Association 2017). Outdoor recreation is also a valued component in quality-of-life indices used to recruit potential employers. Outdoor recreation connects people with wildlife. In well-managed, positive settings, this connection will motivate citizens to support wildlife programs.

TWRA's ability to conserve wildlife relies on funding from outdoor recreation. At present we are primarily funded by hunting, fishing, and boating, but there are other outdoor recreationists that could be charged for use of TWRA lands or TWRA services. For example, the use-permit charged at North Cumberland WMA is applied to all users. Other WMAs, shooting ranges, and water access areas could reasonably ask for similar fees. Increased funding would allow managers to better maintain existing areas and possibly expand opportunities.

TWRA would like to have more hunters and anglers continue these traditions that fund the management of the state's wildlife populations. Many outdoor activities, such as kayaking or hiking, are known to be gateway interests that lead to other activities. Outdoor recreationists that use TWRA lands would have an opportunity to learn about hunting and fishing as a sport. This recruiting opportunity would be a great benefit to TWRA and wildlife resources.

Objectives:

1. Recruit, retain, and reactivate lapsed hunters and anglers as continued and increased participation in outdoor recreation is critical to promote wildlife conservation.
2. Identify types of outdoor recreation that can be supported on TWRA managed lands, while maintaining high satisfaction among existing and expanding user groups.
3. Identify, maintain and/or improve programs that promote high user satisfaction for hunters, anglers, and boaters.

OBJECTIVE 1. Recruit, retain and reactivate lapsed hunters and anglers because continued and increased participation in outdoor recreation is critical to promote wildlife conservation as well as being mission centric.

Issue 1 Decrease barriers to participation in Agency-sanctioned outdoor recreation allowing for the increased recruitment of new participants, retention of current participants, and the reactivation (R3) of lapsed participants into the outdoor recreation community.

Strategy 1 Emphasize programs that promote the introduction of young adults and families to hunting and angling as well as other outdoor activities and promote pond and small lake fishing opportunities in public urban areas, municipal parks, TWRA lakes, and WMAs by the end of the plan period (State Parks fishing programs should be expanded through training of staff and free tackle programs active at a minimum of 10 parks over the plan period)

Strategy 2 Create opportunities to introduce diverse cultures and societies into the hunting, fishing, and shooting sports community

Strategy 3 Create educational opportunities for new participants, current participants, and lapsed participants to promote increased knowledge in outdoor recreation with a focus on hunting and fishing

Strategy 4 Encourage all agency employees to pursue projects in their communities that stress the importance of the recruitment, retention and reactivation of hunting, angling, and shooting sports

Issue 2 TWRA needs to improve partnerships among agencies, organization, and industry to collaboratively implement R3 efforts.

Strategy 1 Host an annual R3 summit for agencies, NGO's, and outdoor industry Stakeholders

Strategy 2 Participate in industry wide 60 in 60 campaign for making 60 million new anglers in 60 months

Strategy 3 Disseminate timely information on Tennessee's efforts to recruit, retain, and reactivate lapsed hunters/anglers, and shooters highlighting successes and opportunities

Strategy 4 Provide grant opportunities to partners to hold TWRA approved R3 events

Strategy 5 Encourage TWRA staff to be involved with partner groups and partner R3 events

Issue 3 TWRA needs to identify existing barriers to participation in hunting/fishing/shooting sports gaining an understanding of how these barriers limit or exclude stakeholder participation in hunting and angling and what strategies can best remove these barriers to participation.

Strategy 1 Review published research on barriers to public participation in outdoor recreation activities

Strategy 2 Gain additional input from stakeholders at a state R3 meeting where all views of the barriers and possible removal of these barriers can be discussed

Strategy 3 Develop partnerships with outdoor recreational organizations to identify issues, solutions, and opportunities for barrier reduction

Strategy 4 Produce an R3 plan providing a roadmap to recruit, retain and reactivate lapsed hunters/anglers/sport shooters which will support the overall strategic vision of the Tennessee Wildlife Resources Agency "to preserve, conserve, manage, protect, and enhance the fish and wildlife of the state and their habitats for the

use, benefit, and enjoyment of the citizens of Tennessee and its visitors. The Agency will foster the safe use of the state's waters through a program of law enforcement, education, and access"

Issue 4 Outdoor recreation opportunities for stakeholders are often limited by external societal factors such as a general lack of time, multiple jobs per family, and travel distance from home. TWRA should seek to minimize these barriers to participation.

Strategy 1 Increase the delivery of special outdoor recreation events targeted at special times and locations designed to minimize external societal barriers

Strategy 2 Design special outdoor recreation events to be more inclusive of families and that provide diverse outdoor activities in one location

Strategy 3 Continue existing programs and expand/develop new programs that will make it easier for people to try outdoor recreation activities (possibilities include: Blue Ribbon Streams, Becoming an Outdoor Woman Events, hunter/angler mentor programs for adults and children, combination programs with 4-H and Boy Scouts, and Hunter Education)

Issue 5 A lack of physical public access (i.e. parking, ramps, and trails) is a limiting factor on many public lands and waterways that could support outdoor recreation activities. New public access areas are difficult to acquire because tracts become available unpredictably and they are often priced above fair market value.

Strategy 1 Increase stakeholder access to public lands and waterways through direct land acquisitions, leases, and partnerships with controlling agencies (i.e. MOAs, MOUs)

Strategy 2 Broaden TWRA acquisition opportunities by developing new partnerships with controlling agencies on public lands and waterways and by continuing to foster existing partnerships

Strategy 3 Continue to ensure existing public access points are maintained year-round and existing leases or MOAs/MOUs are properly updated/renewed

Strategy 4 Provide fishing access (piers, ramps, etc.) and repair existing facilities at a minimum of 20 impoundments over the plan period

Issue 6 The existing TWRA license structure, proclamations, and rules and regulations are perceived by stakeholders as being overly complicated. This perception may be an unintentional

barrier limiting participation in outdoor recreation activities on TWRA managed lands and waterways.

Strategy 1 Continue to review TWRA proclamations and rules/regulations annually to look for opportunities to simplify and clarify both

Strategy 2 Review TWRA land management policies to see if opportunities exist to increase opportunities for diverse outdoor recreation activities

Strategy 3 Facilitate the ability of stakeholders' to efficiently navigate, understand, and select the correct license requirement through a web-based application which would select the correct license/permits based on user inputs

Strategy 4 Consider allowing hunters the flexibility to transfer quota hunt permits to another user and develop policy that would require hunters to check in prior to hunts to validate participation

Issue 7 Existing TWRA public access areas often do not have adequate facilities or existing facilities need upgrade and maintenance to support diverse outdoor recreation activities. Minimum facility requirements need to be established for various outdoor recreation activities that may be provided at given locations.

Strategy 1 Develop policy that establishes minimum access and facility requirements for the various outdoor recreation activities that may be offered on TWRA managed lands and waterways

Strategy 2 Assess the condition of current TWRA access sites and produce a report that addresses current and potential outdoor recreation activities offered, any need for new facilities, and any facilities that require upgrade or maintenance issues on all TWRA managed access sites

Strategy 3 Maintain or improve 16 TWRA public access sites per year at established minimum requirements

Issue 8 Existing TWRA access areas are not completely documented and often not adequately advertised to the public.

Strategy 1 Review TWRA access database for completeness and accuracy once a year

Strategy 2 Promote TWRA access database and maps through TWRA and other partnering media outlets

Strategy 3 Produce mobile applications for public use for locating access areas

Issue 9 Public lands and waterways in Tennessee are controlled and managed by various municipalities, and state and federal agencies. Many of these agencies, either intentionally or unintentionally, often restrict public access to quality fishing, hunting, and boating opportunities.

Strategy 1 Establish working partnerships with agencies controlling access to public lands and waterways and lead efforts within these partnerships to develop plans that promote outdoor recreation activities – primarily fishing, hunting, and boating activities

Issue 10 Tennessee’s land base is largely held under private ownership. A lack of public access to private lands is a limiting factor on many lands and waterways that could support outdoor recreation activities.

Strategy 1 Explore programs that would provide technical and financial assistance to private landowners for wildlife habitat improvement in exchange for short-term or perpetual public access agreements such as the NRCS Voluntary Public Access (VPA) and Habitat Incentive Program (VPA-HIP)

Strategy 2 Increase opportunities for public access to private lands by establishing long-term conservation easements with private landowners

Issue 11 In some waterways, contaminants are present in fish tissue at concentrations that restrict consumptive sport and commercial fishing opportunities. There are also anglers that lack an understanding of contaminant issues and they unnecessarily avoid safe fisheries.

Strategy 1 Continue participating in valley-wide contaminant survey (TDEC, TVA, etc.) for monitoring contaminants in fish, mussels, snapping turtles, etc.

Strategy 2 Report current contaminant advisories in the Tennessee Fishing Guide

Table 1-5. Non-traditional outdoor recreation occurring on TWRA lands

ATV Riding	Geocaching	Photography
Camping	Hiking	SCUBA Diving
Wildlife Watching	Horseback Riding	Sight Seeing
Mountain Bike Riding	Jeeping/Mud Buggies	Skeet Shooting
Target Shooting	Maintaining Cemeteries (Family access)	Swimming

OBJECTIVE 2. Identify types of outdoor recreation that can be supported on TWRA managed lands, while maintaining high satisfaction among existing and expanding user groups.

Issue 1 Predicting which kinds of programs will satisfy new and current users is difficult. Developing new programs or changing existing programs may need to occur to maintain current user satisfaction and recruit new users.

Strategy 1 Assess existing outdoor recreation activities that occur on TWRA managed lands and explore the potential to expand current TWRA programs/management to provide additional outdoor recreation opportunities and produce a report that provides guidance to address current and future outdoor recreational activities on TWRA managed Lands

Strategy 2 Develop partnerships with outdoor recreational organizations to identify issues, solutions, and opportunities for program development

Strategy 3 Foster communication with commercial entities utilizing TWRA lands and facilities for outdoor recreation activities then use these relationships to identify opportunities for partnerships and aid in evaluating issues specific to their industry

Strategy 4 Maintain or develop programs or facilities that increase participation in the shooting sports.

Issue 2 There is an increased demand for TWRA to provide opportunities for a greater diversity of outdoor recreation activities on TWRA managed lands and access areas. To meet this demand additional funding sources will be necessary.

Strategy 1 Investigate costs and revenue associated with existing and expanded recreational activities on TWRA managed lands

Strategy 2 Evaluate non-license holder's willingness to pay for current recreation opportunities and expansion of programs

Strategy 3 Identify areas suitable for the implementation of user fees and evaluate administrative cost to the Agency

Strategy 4 If appropriate, develop user fee structure for WMA's, access areas, non-motorized vessels, special events, and marine events

Strategy 5 Increase partnerships with outdoor recreation groups to develop and maintain facilities and infrastructure necessary to support various outdoor recreation activities (develop long-term MOAs and MOUs)

Issue 3 Conflicts among users and wildlife resource/habitat integrity will increase as the outdoor recreational user base expands and diversifies.

Strategy 1 Evaluate current user base and determine appropriate levels for opportunity expansion or moderation if current use is unacceptable

Strategy 2 Develop strategies to partition use among groups so that conflicts are minimized

Strategy 3 Create partnerships through MOA's and other agreements to reduce or eliminate user conflicts

Strategy 4 Develop policies and procedures that aid in the identification, prioritization, and resolution of user conflict

Strategy 5 Establish communication programs to educate recreational users of potential conflicts and suggest ways that conflicts can be avoided or minimized

OBJECTIVE 3. Maintain or improve programs that promote high user satisfaction for hunters, anglers, and boaters.

Issue 1 Data-driven and science-based management is needed to maintain or increase populations of wildlife that are desired by hunters and outdoor recreationists.

Strategy 1 Develop, implement, and update wildlife species plans as needed to provide direction on management programs

Strategy 2 Conduct wildlife population surveys to provide population estimates or indices using the best available techniques and analyses including counts, banding, hunter harvest surveys, and telemetry; analyze and interpret this data and conduct population modeling as appropriate

Strategy 3 Design, fund, and conduct research necessary to support science-based management

Strategy 4 Prepare and disseminate reports and other technical publications that document the results of scientific research and monitoring activities

Strategy 5 Participate in national and regional working groups that share research and management experience to improve agency species programs

Strategy 6 Provide professional excellence and quality management recommendations through a well-trained, specialized, and dedicated workforce which strengthens the Agency's reputation

Issue 2 Because of habitat limitations or increased demand, many populations of desired species are insufficient to supply consistent and satisfying opportunities to hunters, anglers, and other outdoor recreation users.

Strategy 1 Evaluate current regulations and recommend changes needed to maintain populations of desired species that provide quality hunting, fishing, and other outdoor recreation experiences

Strategy 2 Produce sport fish at desired levels for stocking and evaluate stocking programs to better utilize available resources

Strategy 3 Collect data on participation, satisfaction, opinions, and economic value of programs for TWRA and Tennessee Fish and Wildlife Commission (TFWC) consideration

Strategy 4 Identify new locations or seasons to develop hunting and fishing opportunities or alter management strategies at existing locations to create opportunities

Strategy 5 Develop approaches to allocate hunting opportunities using special hunt drawings, permit drawings, blind drawings, and other techniques that provide equitable distribution of hunters and harvest

Strategy 6 Construct and maintain wildlife management tools (such as nest boxes and other artificial habitat structures) that support and provide benefits to wildlife on TWRA lands

Issue 3 There is a need to ensure that boating education, media/outreach material and learning opportunities address current and emerging issues.

Strategy 1 Use all available media sources to provide timely information on boating safety

Strategy 2 Strengthen TWRA education/learning opportunities

Strategy 3 Develop programs that address specific topics by using current data to determine what the emerging issues are and share with all groups

Strategy 4 Identify all partners and stakeholders, developing shared ideas to accomplish common goals or expand programs

Strategy 5 Provide avenues for emerging user groups to voice boating concerns to TWRA

Issue 4 There is a need to review laws, rules and regulations, and Agency policy regarding boating safety to ensure the boating public has access to safe and enjoyable waterways.

Strategy 1 Annually review boating enforcement procedures to determine if they meet the needs of the Agency and the public in the current legal environment. Make changes as necessary

Strategy 2 Annually review the Boating rules and regulations and TCA Title 69 to determine if they are addressing the current issues in boating safety and are consistent with federal law. Make recommendations for changes to the TFWC and Legislature as appropriate

Issue 5 User groups compete for the same space and resources.

Strategy 1 Take advantage of wildlife management options and identify available natural resources that have not yet been identified for compatible outdoor recreation

Goal:

To protect and conserve Tennessee's fish, wildlife habitats, and public boating opportunities by providing public safety through proactive and responsive law enforcement services.

History:

Agency law enforcement personnel have continuously played a critical role in both protection and conservation of the State's natural resources. It is well known that the main responsibility of the wildlife officer is to enforce the wildlife and boating laws of the State. What is oftentimes not known by those outside the agency is wildlife officers must possess a minimum of a Bachelor's of Science in wildlife or fish management or a closely related field, thus providing the agency with a robust team of highly skilled and knowledgeable wildlife professionals. In the early days of the TWRW, wildlife officers often provided the manpower necessary to complete major restoration projects such as white-tailed deer and wild turkey. Today they are often called upon to conduct biological surveys as well as provide technical assistance to private landowners. Given their versatility, the wildlife officer continues to maintain a presence in all 95 counties of Tennessee. Likewise, as societal needs and expectations have changed the role of the wildlife officer has expanded to include a general enforcement and public safety presence upon public lands and waterways.

Tennessee's waterways were once used as an important means of transportation by the State's earliest residents. As trade developed, vessels of all description and size utilized the rivers as a means of commerce. As the need for flood control and guaranteed channels for commercial navigation increased, two major Federal Agencies became acutely involved in the management of the State's river systems. The Tennessee Valley Authority and the U.S. Army Corps of Engineers impounded streams and guaranteed navigation on the Tennessee, Cumberland, and Mississippi Rivers. Several smaller tributaries were also dammed for flood control, recreation, and hydroelectric power generation. Recreational boating increased as the number of reservoirs increased and in 1965 the Tennessee Game and Fish Commission (now the Wildlife Resources Agency) was designated the sole State Agency charged with managing the State boating program. In that initial year there were 70,899 registered boats. In 1965, a total of 13 accidents were reported including 6 injuries and 2 fatalities. Today, there are over 260,000 registered boats and accidents are averaging 200 per year with fatalities averaging 18 per year. Funding for the Boating program is derived primarily from boat numbering (registration) fees. Other income is generated from a small percentage of the tax on fuel sold at marinas, Federal assistance, fines, and the interest on the boating reserve fund. By law, all boating and wildlife monies must be kept separately and may only be expended within their respective programs. Currently, there are over 84,000 boating safety compliance inspections conducted annually by wildlife officers.

The Tennessee Hunter Education Program (THEP) was established as a formal hunter education program in 1972. Since the Agency's inception, hunting and firearm related accidents in Tennessee have declined dramatically. Hunter safety certification via the THEP is recognized by all states, Canada, and Mexico.

Since 1985, Tennessee has required by law the completion of the THEP as a prerequisite to obtaining a hunting permit in the state for all persons born on or after January 1, 1969. All hunters age 10 and older are required to be in possession of a Hunter Education certificate while in the field, and those under 10 must be accompanied by an adult of at least 21 years of age who has completed the course and who must remain in a position to take immediate control of the hunting device. The course is offered free of charge and consists of a minimum of 10 hours of classroom participation; although most courses generally last 12-16 hours. Students are then required to successfully pass a written examination and a live firing exercise. The course contains instruction on ethics, marksmanship, history of hunting and firearms, wildlife management and identification, laws, knowledge of firearms and ammunition, wilderness survival, emergency first aid, etc. TWRA currently certifies over 15,000 students each year and has certified over 723,000 students since 1972.

A mandatory boating education law was passed in the Tennessee General Assembly in 2004 and went into effect in January 2005. The law affects any Tennessee resident born after January 1, 1989 who operates a vessel alone and who is at least twelve years old. The law requires that a student pass a monitored exam administered by an approved representative of TWRA. In addition, many county libraries across the state administer the exam via a secure Internet web site. Classes are offered across the state by TWRA personnel, School Resource Officers, U.S. Coast Guard Auxiliary, U.S. Power Squadrons, driver education teachers, boy scouts, and many more. TWRA currently certifies over 7,500 students each year and has certified over 79,000 students since 2005.

Objectives:

1. Provide public safety, resource protection, and technical assistance which enhance the public's quality of life.
2. Provide a diverse, well-trained, and equipped professional workforce that is dedicated to wildlife and resource protection which strengthens the Agency's reputation.
3. Enhance the public's outdoor experiences in Tennessee through recruitment, retention, and reactivation.
4. Provide emergency responses during critical incidents such as environmental and natural disasters through mutual aid efforts with our local, state, and federal partners.
5. Develop and enforce needed changes in Tennessee's fish, wildlife, and boating regulations to ensure currency for resource protection and the public's necessities.

OBJECTIVE 1. Provide public safety, resource protection, and technical assistance which enhance the public's quality of life.

Issue 1 Population growth has resulted in increased pressures on resources and has created increased calls for wildlife officer services.

Strategy 1 Prioritize wildlife officers work efforts to meet the increased number of calls for service

Strategy 2 Develop external funding sources to establish full time Sergeant positions and hire additional county officers

Issue 2 Changes in population dynamics have increased the calls for wildlife officer services for nuisance wildlife.

Strategy 1 Establish funding for commissioned nuisance wildlife/captive wildlife positions

Strategy 2 Provide technical advice to private landowners regarding wildlife resource management

Issue 3 Cultural changes have increased the threat to public safety non-related to hunting/fishing/boating showing the need for non-traditional training and equipment

Strategy 1 Identify the need and availability and provide specialized training

Strategy 2 Evaluate the need for specialized investigative teams based on current law enforcement, and criminal trends

OBJECTIVE 2. Provide a diverse, well-trained, and equipped professional workforce that is dedicated to wildlife and resource protection which strengthens the Agency's reputation.

Issue 1 Expected losses in workforce due to retirement may lead to significant loss of institutional knowledge.

Strategy 1 Initiate and implement a succession plan for the Agency's future law enforcement leadership

Strategy 2 Improve the law enforcement hiring process by conducting a more detailed and comprehensive background investigation prior to officer candidate selection to ensure the best candidates are offered positions

Strategy 3 Continue to fund training opportunities with established leadership training academies

Strategy 4 Improve and maintain the initial officer training/indoctrination process to better establish the tenor of a new employee's career as it relates to development of a professional ethos

Issue 2 There is a trend that there are less qualified candidates interested in Conservation Law Enforcement.

Strategy 1 Identify a wider range of degrees that would be acceptable for Wildlife Officer candidates

Strategy 2 Establish recruitment tools to be used at high schools, universities, outdoor shows and other recruitment opportunities

Issue 3 Wildlife Officers encounter a wide variety of user groups which have a higher expectation level of the officer's responsibilities.

Strategy 1 Maintain and improve current law enforcement training

Strategy 2 Identify additional training needs and establish through documentation a training record for all mandatorily commissioned personnel

Strategy 3 Identify and facilitate the use where applicable of non-traditional training opportunities (distance learning) for all enforcement personnel

Strategy 4 Develop a law enforcement website for public access which will highlight officer actions and provide a greater understanding of officer duties

Issue 4 Advancement in equipment technologies is constantly changing and there is a need for officers to stay current with these changes.

Strategy 1 Identify new and replacement equipment needs

Strategy 2 Budget for new and replacement equipment

Strategy 3 Initiate and fund a research and development committee to identify new equipment needs for officers

OBJECTIVE 3. Enhance the public’s outdoor experiences in Tennessee through recruitment, retention, and reactivation.

- Issue 1 There is an increased demand for Wildlife Officers to provide outreach programs.
- Strategy 1 Provide more opportunities for the public to attend a hunter education course; specifically, increase the number of available hunter education field days
- Strategy 2 Increase educational and testing opportunities for boating education through the increased development of a cadre of volunteers
- Strategy 3 Coordinate with other agency divisions to provide updated and current educational materials

OBJECTIVE 4. Provide emergency responses during critical incidents, environmental and natural disasters through mutual aid efforts with our local, state, and federal partners.

- Issue 1 Activation and deployment of our manpower and assets are a constant unknown.
- Strategy 1 Remain an active member in emergency response organizations such as Tennessee Emergency Management Agency (TEMA), Federal Emergency Management Agency (FEMA), Homeland Security Administration (HSLA), etc.
- Strategy 2 Establish and monitor activation plans
- Strategy 3 Maintain a high level of readiness with our equipment and training
- Strategy 4 Conduct annual review of Agency’s operations manual to ensure the Agency’s role is within acceptable guidelines
- Strategy 5 Provide advanced incident command system training
- Strategy 6 Identify recurring events throughout the State which currently require or are likely to require involvement of agency personnel in the future (concerts, fireworks, races, sporting events etc.) to develop and maintain detailed contingency plans for each event
- Issue 2 Constant and emerging technologies in radio communications have superseded available funding.

Strategy 1 Budget future dollars

Strategy 2 Apply for grant funding

Strategy 3 Establish a priority list and criteria to identify locations where communications must be installed and/or replaced

OBJECTIVE 5. Develop and enforce needed changes in Tennessee's fish, wildlife, and boating regulations to ensure currency for resource protection and the public's necessities.

Issue 1 Hunting and fishing regulations can be confusing and complicated to the public.

Strategy 1 Conduct annual review of regulations to address areas that could be combined and/or simplified to increase compliance

Strategy 2 Develop platforms that user groups can easily access to obtain current information on regulations

Issue 2 There is a need for wildlife officers to provide informed and educated recommendations for wildlife/fisheries management and public access to Agency-controlled properties and public waters.

Strategy 1 Participate in the Agency's evaluation and decision-making process

Strategy 2 Present officer recommendations for wildlife/fish management changes through appropriate meetings and season settings

Goal:

Recruit, Retain, and Reactivate hunters, anglers, target shooters, and boaters through quality communications and information as well as relevancy themed communications efforts to educate the public about work that TWRA does to benefit all Tennesseans. To supply the public and agency personnel with a constant flow of information necessary for attaining the management and conservation goals of the Agency, as well as the most current rules and regulations.

Introduction:

The Outreach and Communications (O&C) and Multimedia Divisions work to enhance the Agency's public image by highlighting the quality work of its dedicated, professional staff of Wildlife and Boating Officers, Biologists, Land Managers, and administrative support personnel.

The O&C Division also strives to be a conduit for public information from the various divisions of the Agency. By working with the Wildlife, Fisheries, Law Enforcement and other Divisions within the Agency, O&C has been able to promote Agency messages through news releases, demonstration videos and personal appearances with TV and radio media outlets. The increased popularity of electronic messaging has also become a primary conduit for information sharing. The TWRA's website hosts a wealth of information for anyone interested in learning about Tennessee's wildlife resources. To go along with standard web pages, the site also offers produced educational webcasts, recorded TFWC meetings, access to all of the Agency's big game data, and a complete network of contact information allowing the public to find and reach the best source of wildlife information.

Objectives:

1. Be a constant source of easily accessible and accurate information to the public regarding the Tennessee Wildlife Resources Agency and the management of Tennessee's wildlife resources.
2. Implement and/or facilitate programs to maintain and recruit new stakeholders in Tennessee's wildlife resources.
3. Provide information to the public to enhance and increase their knowledge and participation in outdoor recreational activities such as hunting, fishing, boating, and wildlife watching.
4. Work closely with the Tennessee Wildlife Resources Foundation (TWRF) and other groups to market various Agency assets and initiatives with a goal of creating revenue to help offset costs.
5. Continue and expand internal agency information sharing
6. Shining a positive light on hunting, fishing, target shooting, and boating to maintain or increase agency relevancy

OBJECTIVE 1. Be a constant source of easily accessible and accurate information to the public regarding the Tennessee Wildlife Resources Agency and the management of Tennessee's wildlife resources.

Issue 1 The public may not understand or be aware of wildlife management issues and/or outdoor recreational opportunities (e.g., boating, wildlife watching) in Tennessee.

Strategy 1 Develop new and support existing outreach efforts to inform the public about wildlife management issues especially the extrinsic factors that may negatively impact our resources (invasive species, diseases, climate change)

Strategy 2 Use tools such as the Tennessee Wildlife Magazine and Tennessee's Wild Side TV program to showcase the many facets and scope of the work TWRA does beyond selling hunting and fishing licenses

Strategy 3 Participate in outdoor shows, boat shows, county fairs and other strategic venues that allow our personnel to interact with the public

Strategy 4 Take advantage of public speaking opportunities at schools, civic groups, and other venues

Strategy 5 Offer training (e.g., public speaking) for those TWRA personnel who will be in direct contact with the public

Strategy 6 Consistently assess needs of the Agency and develop printed materials to distribute at venues described above

Strategy 7 Develop and keep current topic-specific presentations depicting specific agency operations, projects, and global initiatives suitable for a variety of community outreach activities

Issue 2 TWRA's role in managing wildlife and boating in Tennessee is sometimes misunderstood by other government entities.

Strategy 1 Work closely with our legislative liaison to provide tools to inform Senators and Representatives about issues concerning TWRA

Strategy 2 Help with logistical support, audio/visual needs for any events TWRA may host where legislators are invited to attend

Strategy 3 Create specific multimedia projects, as needed, to educate legislators and other political decision makers as issues arise

OBJECTIVE 2. Implement and/or facilitate programs to maintain and recruit new stakeholders in Tennessee's wildlife resources

- Issue 1 As our society becomes more urban, fewer young people get exposed to outdoor activities, or know of TWRA and its mission. Many have no mentor to introduce them to hunting or fishing.
- Strategy 1 Conduct human dimension surveys to ascertain which recruitment programs are most successful and to identify potential stakeholders that are yet untapped
- Strategy 2 Continue and develop programing aimed at educating potential participants, current participant and lapsed participants in hunting, fishing, and the shooting sports
- Strategy 3 Continue and develop targeted promotion to young adults and families to move them to participate in hunting, angling, and the shooting sports
- Strategy 3 Continue or develop programs which target individuals interested in the shooting sports (e.g., National Archery in the Schools program and Scholastic Clays Target Program), and that promote knowledge of wildlife and TWRA's mission to teachers and students (e.g., Project Wild)
- Strategy 4 Continue to support the rising generations of wildlife professionals by providing volunteer opportunities that educate and give experience in wildlife management practices and principles to university students pursuing conservation majors
- Strategy 5 Seek opportunities to present outdoor related programs to school administrators and decision makers to maximize efforts to grow the programs within Tennessee's educational system
- Strategy 6 Publicize the urban trout stocking program and other fish stocking efforts
- Strategy 7 Continue or develop outdoor related programs which target minorities and other non-traditional user groups (e.g., Becoming an Outdoors Woman)
- Strategy 8 Implement a system to allow officers to report local outdoor events so they can be more efficiently advertised to the public
- Strategy 9 Use social media to promote events mentioned above and promote the sharing of information with their friends

OBJECTIVE 3. Provide information to the public to enhance and increase their knowledge and participation in outdoor recreational activities such as hunting, fishing, and boating

- Issue 1 Outdoor recreation opportunities for stakeholders are often limited by external societal factors such as a general lack of time, multiple jobs, and travel distance from home. TWRA should seek to minimize those barriers to participation.

Strategy 1 Use various media including but not limited to print, television, radio, and internet to showcase the many opportunities we must participate in outdoor recreation

Strategy 2 Strive to present regulations in the simplest and most understandable way

Strategy 3 Generate news releases on a regular basis, informing media outlets about changes in regulations and policies that affect the hunting and angling public

Strategy 4 Increase the delivery of special outdoor recreation events targeted at special times and locations designed to minimize external societal barriers

Strategy 5 Maintain and improve customer service by constantly updating information to personnel answering front-line phone calls, emails, and social media requests from the public

Strategy 6 Develop a budget to buy media such as radio and TV spots to publicize license buying, and encourage participation in outdoor activities

Strategy 7 Continue to produce a webcast of the TFWC meetings, providing the public a window into the decision-making process

Issue 2 Existing TWRA access areas are not completely documented and often not adequately advertised to the public.

Strategy 1 Create and review TWRA access database (to include fishing and hunting access points) for completeness and accuracy at least once per year

Strategy 2 Promote TWRA access database and maps through TWRA's website and other partnering media outlets

OBJECTIVE 4. Work closely with the Tennessee Wildlife Resources Foundation (TWRF) and other groups to market various Agency assets and initiatives with a goal of creating revenue to help offset costs

Issue 1 The Agency lacks the services of a full-time marketing Director.

Strategy 1 Take an active role in the selection of the person who will handle the marketing of TWRA assets as the Foundation Marketing Director

Strategy 2 Work closely with the TWRF Marketing Director and other Foundation staff to help facilitate success

Strategy 3 Conduct strategy and brainstorming sessions aimed at seeking new, innovative marketing ideas on a quarterly basis

Issue 2 There is a lack of information regarding Agency assets that can be marketed.

Strategy 1 Assess complete inventory of Agency assets which have value to a potential corporate contributor (e.g., space in our Tennessee Wildlife Magazine or our hunting/fishing guides and sponsorship of our TV program)

Strategy 2 Work to incorporate this marketing approach within the Agency as we produce future print, TV, web, and other I&E assets

Strategy 3 O&C Chief and Assistant Chief should assist TWRF Marketing Director in developing the overall marketing plan

Issue 3 Allow TWRF to facilitate the production of Agency publications.

Strategy 1 Assess complete inventory of Agency publications with a goal of turning over the production of these to the TWRF

Strategy 2 Allow the dollars generated through the marketing efforts of the TWRF to cover total cost or greatly reduce our costs of production

Strategy 3 Work closely with TWRF to maintain creative control of the editorial content of publications mentioned above

OBJECTIVE 5: Continue and expand internal agency information sharing

Issue 1 Provide materials and avenues for internal communications

Strategy 1 Continue internal publications such as Shoptalk

Strategy 2 Evaluate new technologies and assess their effectiveness in the dissemination of information to employees

Issue 2 Standardize law enforcement news releases

Strategy 1 Standardize the format of all news releases relative to enforcement and or investigatory situations, developing one for both juveniles and adults

Strategy 2 Evaluate and develop a web-based application to provide the required information from field personnel to Multimedia and O&C personnel for time sensitive news releases, and press conferences

OBJECTIVE 6: Shining a positive light on hunting, fishing, target shooting, and boating to maintain or increase agency relevancy

Issue 1 Feature outdoor recreation and work that the agency does on all owned media channels

Strategy 1 Continue to use the Making It Last Toolkit for reaching people that don't hunt or fish

Strategy 2 Use the relevancy roadmap created by AFWA to assist the agency in becoming more relevant to the general populous

Strategy 3 Form internal committee for relevancy/diversity/inclusion tactics to prioritize tactics for the agency to accomplish

Definitions:

Agency	The Tennessee Wildlife Resources Agency. (Defined by T.C.A. 70-1-101)
Big Game	Deer, bear, wild turkey, and all species of large mammals that may be introduced or transplanted into this state for hunting. (Defined by T.C.A. 70-1-101)
Commission	The Tennessee Fish and Wildlife Commission, and "Commissioner" means a member of the Fish and Wildlife Commission. (Defined by T.C.A. 70-1-101)
Conserve	To keep in a safe or sound state; especially to avoid wasteful or destructive use of. (Merriam-Webster)
Enhance	To increase or improve in value, quality, desirability, or attractiveness. (Merriam-Webster)
Executive Director	The executive director of the Tennessee Wildlife Resources Agency. (Defined by T.C.A. 70-1-101)
Fish	All species of trout, salmon, walleye, northern pike, bass, crappie, bluegill, catfish, perch, sunfish, drum, carp, sucker, shad, minnow, and such other species of fish that are presently found in the state or may be introduced or transplanted into this state for consumptive or non-consumptive use. (Defined by T.C.A. 70-1-101)
Fishing	Any effort made to take, kill, injure, capture, or catch any fish and every act of assistance in any effort. (Defined by T.C.A. 70-1-101)
Furbearer	Beaver, raccoon, skunk, groundhog, coyote, gray fox, red fox, mink, muskrat, otter, weasel, bobcat, and opossum, and all subspecies or variations of the foregoing, and any other animals that may be declared by the commission under regulation to be a fur bearer. (Defined by T.C.A. 70-1-101)
Hunting	Chasing, driving, flushing, attracting, pursuing, worrying, following after or on the trail of, searching for, trapping, shooting at, stalking, or lying in wait for, any wildlife, whether or not such wildlife is then or subsequently captured, killed, taken, or wounded and every act of assistance to any other person, but "hunting" does not include stalking, attracting, searching for, or lying in wait for, wildlife by an unarmed person solely for the purpose of watching wildlife or taking pictures of wildlife. (Defined by T.C.A. 70-1-101)
Maintain	To keep in an existing state: preserve from failure or decline. (Merriam-Webster)

Nongame bird	All species of birds not classified as game birds. (Defined by T.C.A. 70-1-101)
Nongame Mammal	All species of wild mammals not classified as big game, small game, or fur bearers. (Defined by T.C.A. 70-1-101)
OHV	Off-highway vehicle
Perpetuate	To cause (something that should be stopped, such as a mistaken idea or a bad situation) to continue (Merriam-Webster)
Protect	To shield from exposure, injury, damage, or destruction: guard. (Merriam-Webster)
Refuge	A specific land or water area, or both, that is established for the protection of one (1) or more species of wildlife with no, or limited forms of, consumptive uses, and limited non-consumptive use to the degree compatible with desired wildlife protection. (Defined by T.C.A. 70-1-101)
Small Game	Furbearers, game birds, swamp rabbits, bullfrogs, cottontail rabbits, fox squirrels, gray squirrels, red squirrels, and all species of small mammals and birds that may be introduced into this state for hunting. (Defined by T.C.A. 70-1-101)
TNSWAP	Tennessee State Wildlife Action Plan
Trapping	Taking, killing, and capturing wildlife by the use of any trap, snare, deadfall, or other device commonly used to capture wildlife, and the shooting or killing of wildlife lawfully trapped, and includes all lesser acts such as placing, setting, or staking such traps, snares, deadfalls, and other devices, whether or not such acts result in taking of wildlife, and every attempt to take and every act of assistance to any other person in taking or attempting to take wildlife with traps, snares, deadfalls, or other devices. (Defined by T.C.A. 70-1-101)
Wildlife	Wild vertebrates, mollusks, crustaceans, and fish (Defined by T.C.A. 70-1-101)
Wildlife Management Area (WMA)	A specific land or water area, or both, that is established for the intensive management of both habitat and wildlife species for optimum enhancement and use by both consumptive and non-consumptive users (Defined by T.C.A. 70-1-101)

Contributors to this Document:

Case and Wallace (2011) concluded that if the Agency were to change from a species-based strategic plan to a habitat-based approach, it must embrace the need for transformational change. It was decided that the best way to get the Agency believing, accepting, and trusting in this new approach is to get everyone involved. Therefore, this document was created from input from all divisions and regions as well as all levels of professional staff. We graciously thank the following contributors:

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Literature Cited:

- Adams, C.E. and K.J. Lindsey. 2010. Urban Wildlife Management. CRC Press, Boca Raton, FL, USA.
- Black, W.P. 2020. Tennessee Reservoir Creel Report 2020. Fisheries Report 12-05. Tennessee Wildlife Resources Agency, Nashville, TN, USA.
- Case, D.J. and G. Wallace. 2011. Strategic Plan Assessment, A Strategic Plan Assessment for the Tennessee Wildlife Resources Agency. D.J. Case and Associates. Mishawaka, IN, USA.
- Happ, S.C., Rittenhouse, G., Dobson, G.C., 1940. Some principles of accelerated stream and valley sedimentation. Technical Bulletin No. 695. U.S. Department of Agriculture, , Washington, DC, USA., 133 pp.
- Louv, R. 2005. *Last Child in the Woods*. Algonquin Books, New York, New York.
- Nowak, D.J., J.T. Walton, J.F. Dwyer, L.G. Kaya, and S. Myeong. 2005. The increasing influence of urban environments on US forest management. *Journal of Forestry* 103(9):377-382.
- Nowak, D.J., and J.T. Walton. 2005. Projected urban growth (2000-2050) and its estimated impact on the US forest resource. *Journal of Forestry* 103(9): 383-389.
- Outdoor Industry Association. 2017. The Outdoor Recreation Economy.
https://outdoorindustry.org/wp-content/uploads/2017/04/OIA_RecEconomy_FINAL_Single.pdf
- Schexnayder, S.M. and J.M. Fly. 2012. Anglers in Tennessee: Fall 2010. University of Tennessee. Department of Forestry, Wildlife and Fisheries, Knoxville, TN, USA.
- Schexnayder, S.M., A. Griffin and J.M. Fly. 2012. Nuisance Wildlife in Tennessee: Spring 2012. University of Tennessee, , Department of Forestry, Wildlife and Fisheries, Knoxville, TN, USA.
- Tennessee Valley Authority. 1980. Engineering data, TVA water control projects. Technical monograph #55, Volume 1, parts 1 and 2. Tennessee Valley Authority, Knoxville, TN, USA.
- Tennessee Wildlife Resources Agency. 2006. Strategic wildlife resources management plan for the start of a new millennium. Reservoir Plan, Chapter 15. Nashville, TN, USA.
- Tennessee Department of Agriculture. 2010. Tennessee Forest Resource Assessment and Strategy. Tennessee Department of Agriculture, Nashville, TN, USA.
- Tennessee Wildlife Resources Agency. 2009. Climate Change and Potential Impacts to Wildlife in Tennessee. Tennessee Wildlife Resources Agency, Wildlife Technical Report 09-09, Nashville, TN, USA.
- U.S. Army Corps of Engineers. 1978. Project maps and data sheets covering authorized projects. U.S. Army Engineer District, Nashville, TN, USA.

U.S. Fish and Wildlife Service. 2016. 2016 National survey of fishing, hunting, and wildlife-associated recreation. Washington D.C., USA.

U.S. Geological Survey. 2003. Water-Resources Investigations Report 03-4264, Reston, VA, USA.

Veni, G, H. DuChene, N. C. Crawford, C. G. Groves, G. N. Huppert, E. H. Kastning, R. Olson, B. J. Wheeler. 2001. Living with karst a fragile foundation. American Geological Institute Environmental Awareness Series 4.

White, E.M., A.T. Morzillo, and R.J. Alig. 2009. Past and projected rural landscape conversion in the US at state, regional, and national levels. *Landscape and Urban Planning* 89:37-48.